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ABSTRACT:

This document represents the Committee Draft for Comment version of ISO 10303 Part 226 that deals with ship mechanical systems data representation for the purpose of electronic data interchange. Ships mechanical systems, within the scope of this standard, include ship's propulsion systems, auxiliary systems and deck machinery systems, together with their components. Product data pertaining to all lifecycle phases of ship mechanical systems are in the scope of this standard. The lifecycle phases covered include specification, selection, installation, commissioning, operation, in-service inspection, maintenance and decommissioning.

KEYWORDS:

application protocol; ship equipment; ship machinery; ship mechanical systems; ship propulsion system; ship auxiliary systems; lifecycle; mechanical product.

COMMENTS TO READER:

This is the fourth Working Draft of AP226 and contains all the major amendments due to the international industrial review of previous Working Draft reference ISO TC184/SC4/WG3 N730 dated 16 March 1998. The resolution of issues resulting from industry review of the previous Working Draft, as agreed by AP226 Expert Working Group and SC4 WG3 T23 Ship Team, are also included.

This Working Draft will be used as the basis for interpretation of AP226 and preparation of the Committee Draft of this standard.

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Foreword

ISO (International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body, interested in a subject for which a technical committee has been established, has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75% of the member bodies casting a vote.

International Standard ISO 10303-226 was prepared by Technical Committee ISO/TC 184, *Industrial automation systems and integration, Subcommittee SC4, Industrial data*. Many organisations have contributed and sponsored the development of this standard through various projects. The contributions of the following are acknowledged:

- **ShipSTEP:** A European industry funded project, ran from 1994 to 1996, with 8 European companies contributing to the development of shipbuilding Application Protocols.
- **EMSA** (European Marine Step Association): EMSA was founded in 1995 to co-ordinate European Marine Step developments and embraces the main European Shipbuilders, Classification Societies and marine software vendors.
- **NIDDESC II** (Navy Industrial Digital Data Exchange Standards Committee): The USA Navy Industrial Digital Data Exchange Standards Committee was formed in 1986 as a cooperative effort by the Naval Sea Systems Command (NAVSEA) and the National Shipbuilding Research Program (NSRP) to collect and exchange information on product model data requirements and to ensure that benefits expected by industry and Navy are incorporated into national and international data exchange standards. The NIDDESC effort has resulted in the development of a suite of product model data exchange specifications. These exchange specifications have been submitted to the ISO TC184 SC4 in 1993 for inclusion in the series of ISO 10303 application protocols, which form the ship product model data.
- **EDIMAR** (Electronic Data Interchange in the European MARitime Industry): European Union funded project, ran from 1997 to 1998, with 11 European companies contributing to the development of the shipbuilding aspects of AP226.
- **AP226 EWGs** (Expert Working Groups): Many organisations have contributed to this part through active participation in AP226 EWGs within which the application experts' view and consensus were sought with regard to industry requirements. These EWGs had a significant level of e-mail discussion on related issues and also held formal workshops.
- **MOSys** (Models for Operational Reliability, Integrity and Availability Analysis of Ship Machinery Systems): European Union funded project, ran from December 1997 to December 2000, with 8 European companies contributing to the development of the ship operation aspects of AP226.

Introduction

ISO 10303 is an International Standard for the computer-interpretable representation and exchange of product data. The objective is to provide a neutral mechanism capable of describing product data throughout the life cycle of product and independent from any particular system. The nature of this description makes it suitable not only for neutral file exchange, but also as a basis for implementing and sharing product databases and archiving.

This International Standard is organised as a series of parts, each published separately. The parts of ISO 10303 fall into one of the following series: description methods, integrated resources, application interpreted constructs, application protocols, abstract test suites, implementation methods and conformance testing. The series are described in ISO 10303-1. This part of ISO 10303 is a member of the application protocol series. This part of ISO 10303 specifies an application protocol (AP) for the exchange of data pertaining to all life-cycle phases of ship mechanical systems.

The principal focus of this part of ISO 10303 is:

- Ship propulsion system including main engine, propulsor and shafting systems.
- Auxiliary systems including fuel oil, lube oil, power generation, cooling water system, and steam generation systems.
- Deck machinery including cranes, derricks and winches.

This application protocol is one of the series of ship product application protocols as shown in Figure 1. The series of ship industry application protocols assumes that the ship product model can be divided into separate ship systems that each covers a key element of the ship for its whole life cycle. These key elements are:

- ship moulded forms;
- ship arrangements;
- ship distribution systems (piping, heating, ventilation and air conditioning, as well as electrical and cableway);
- ship structures;
- ship mechanical systems;
- ship outfit and furnishings;
- ship mission systems.

Each separate system is described by one or more different application protocols. The full series of shipbuilding application protocols is depicted in Figure 1.

The information requirements for ship mechanical systems have been organised in a series of units of functionality (UoF). Figure 2 shows the units of functionality for this part of ISO 10303 in the form of AP226 data planning model. For further introductory information of STEP, AP226 and its data planning model, please refer to annex L.

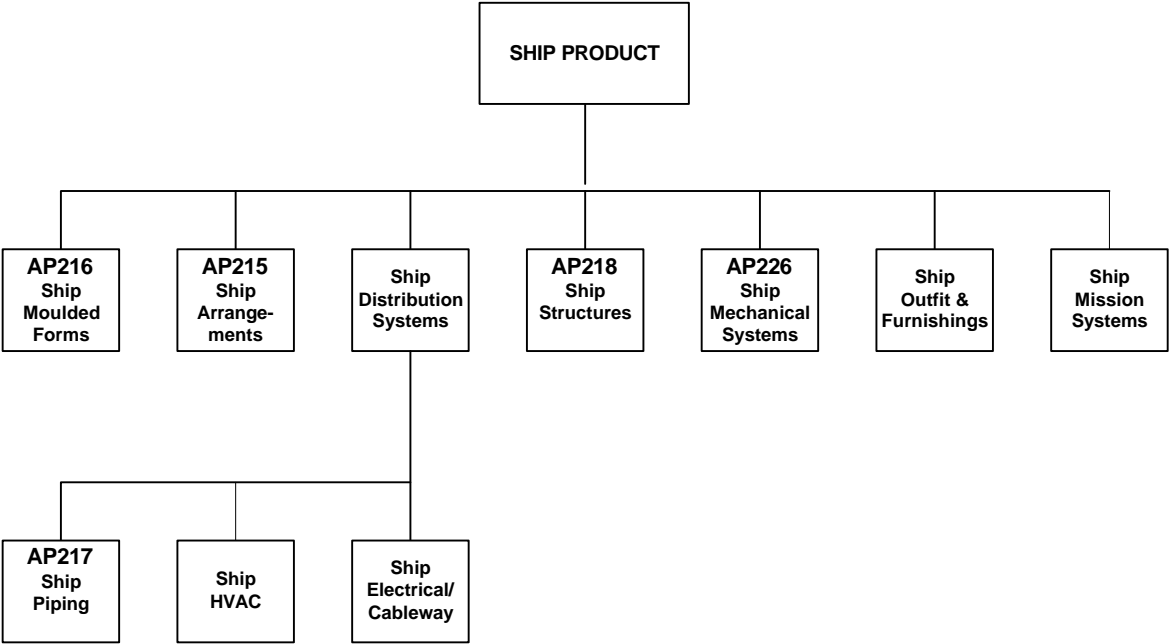


Figure 1 - Ship product application protocols

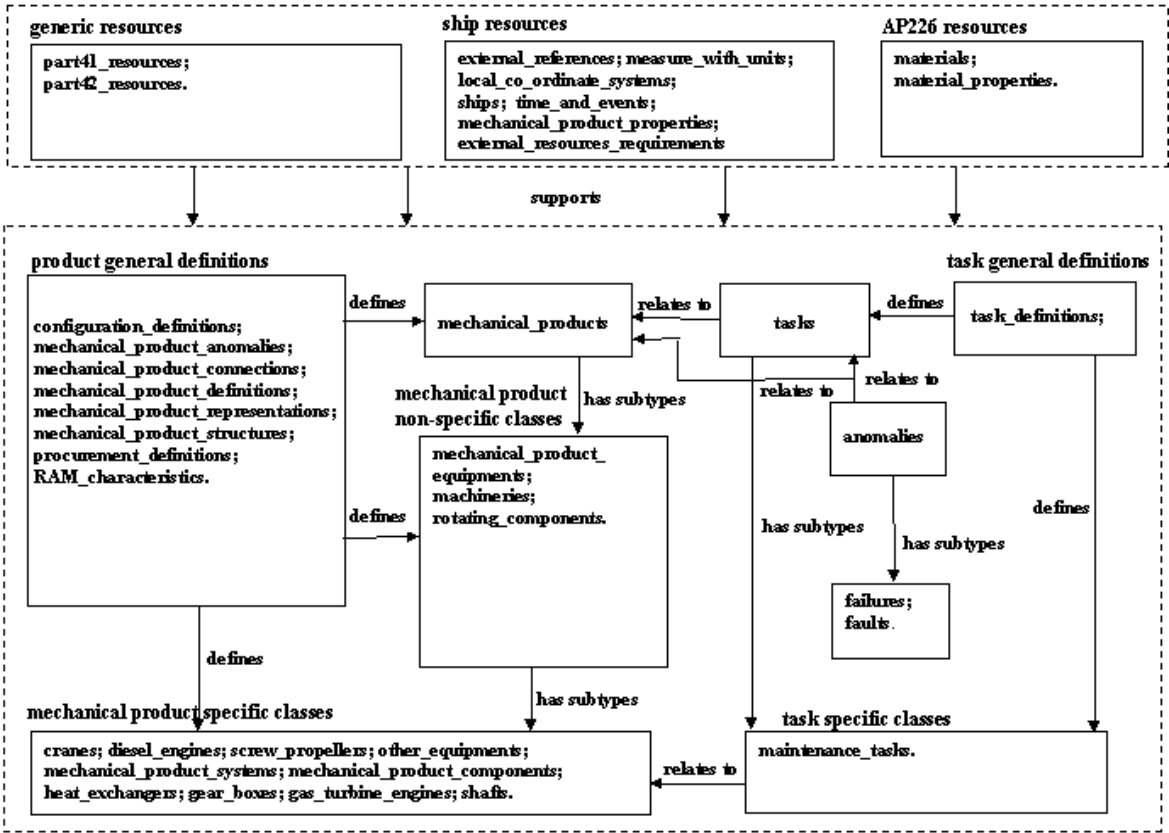


Figure 2 - AP226 Data Planning Model

This part supports and interacts with the following parts of ISO 10303.

ISO 13584: parts library

AP226 supports external references to classes defined by ISO 13584. This part of ISO 10303 supports the exchange of standard parts catalogues used to define specific items within ship mechanical systems. A standard parts catalogue may be exchanged as part of a design, or referenced by a customer to a contractor in order to specify the standard parts that shall be used.

ISO 10303-221: Application Protocol: Functional data and their schematic representation for process plant.

This part of ISO 10303 supports external references to classes of properties defined by ISO 10303-221.

ISO 10303-215: Application protocol: Ship Arrangements

ISO 10303-216: Application protocol: Ship Moulded Forms.

ISO 10303-217: Application protocol: Ship Piping Systems.

ISO 10303-218: Application protocol: Ship Structures

Application protocols provide the basis for developing implementations of ISO 10303 and abstract test suites for the conformance testing of AP implementations.

Clause 1 defines the scope of the application protocol and summarises the functionality and data covered by the application protocol. Clause 2 provides a list of normative references. Clause 3 lists the vocabulary defined in this part of ISO 10303 and gives pointers to vocabulary defined elsewhere. An application activity model that is the basis for the definition of the scope is provided in annex F. The information requirements of the application are specified in clause 4 using terminology appropriate to the application. A graphical representation of the information requirements, referred to as the application reference model (ARM), is given in annex G.

Resource constructs are interpreted to meet the information requirements. This interpretation produces the application interpreted model (AIM). This interpretation, given in clause 5.1, shows the correspondence between the ARM and the AIM. The short listing of the AIM specifies the interface to the integrated resources and is given in clause 5.2. Note that the definitions and EXPRESS provided in the integrated resources for constructs used in the AIM may include select list items and subtypes which are not imported into the AIM. The expanded listing given in annex A contains the complete EXPRESS for the AIM without annotation. A graphical representation of the AIM is given in annex H. Additional requirements for specific implementation methods are given in annex C.

Industrial automation systems and integration - Product data representation and exchange - Part 226: Application Protocol: Ship Mechanical Systems

1 Scope

This part of ISO 10303 specifies the use of the integrated resources necessary for the scope and information requirements for the exchange of ship mechanical systems information.

NOTE the Application Activity Model (AAM) in Annex F provides a graphical representation of the processes and information flows which are the basis for the definition of the scope of this part of ISO 10303.

The following are within the scope of this Part of ISO 10303:

- the representation of the mechanical systems and their principal components for both naval and commercial ships;
- the product definition data pertaining to the following lifecycle phases of the ship mechanical systems:
 - specification;
 - design/selection;

NOTE the design data will be supported for those components that are designed and manufactured within the context of marine industry as shown in AAM (Annex F). For example, data necessary to design a diesel engine will not be supported while data required to design a marine propulsor will be supported.

- approval;
 - installation;
 - commissioning/acceptance;
 - operation;
 - in-service inspection and maintenance;
 - decommissioning/disposal.
- the product definitions of the following mechanical systems:
 - the components in the systems that supply air to the engine room such as engine room ventilation fans and exhaust gas system such as silencers, economiser and so on.
 - the components in the fuel oil treatment and supply systems, engine lubricating system and engine cooling system.

- the propulsion system: including main engines, shafts, couplings, gearing and propulsor;
- the manoeuvring system, consisting of the rudder, stock and actuator; thrusters including azimuthing thrusters; hydroplanes stock and actuator; stabilisers; cycloidal propeller type units; pivoting nozzles and water jet type systems.
- the power systems including electric propulsion and auxiliary electrical generation;
- the product definitions of the following mechanical components:
 - pumps necessary for the operation of the main propulsion and essential machinery such as boiler feed, condensation extraction, fuel oil pumps, lubricating oil pumps and cooling water pumps.
 - the auxiliary machinery such as heat exchangers, air compressors and air receivers;
 - boilers;
 - auxiliary engines and thruster units;
 - deck machinery such as windlasses, winches, capstans, general purpose cranes and derricks;
- the distinction between the physical specifications and the functional specifications of various systems and components.
- the following product definition information:
 - the functional and physical connectivity between components and between systems including physical connectivity of equipment to ship structure;
 - functional description of components and systems such as performance and operational characteristics;
 - geometric representation of systems and components to a level compatible to lifecycle phases of the corresponding system and component;
 - technological information such as material, tolerance, noise, vibration, shock and stress characteristics;
 - data that are necessary for tracking a component's lifecycle and operational history such as specification, in-service inspection and maintenance data.

The following are outside the scope of this Part of 10303:

- the product definition data and physical connectivity pertaining to the following components and systems including:
 - the piping arrangements not integral to the machinery unit;
 - the electrical distribution systems not integral to the machinery unit;
 - the control systems not integral to the machinery unit;

- the nuclear steam raising plant;
- maintenance equipment such as cranes, tools and so on;
- the ship's arrangement and compartmentation;
- the ship's Heating, Ventilation and Air Conditioning (HVAC) systems;
- the mission specific mechanical systems of the ship including:
 - cargo refrigeration
 - naval military equipment
- the outfitting of the ship, including hatch covers, watertight doors, fire fighting appliances, anchor and chain cables, davits and lifesaving appliances, sewage systems;
- data relating to the manufacture of the components.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 31:1994, *Quantities and Units*.

ISO 1000:1992, *SI units and recommendations for the use of their multiples and of certain other units*.

ISO 8824-1:1994, *Information Technology — Open Systems Interconnection — Abstract Syntax Notation One (ASN.1) — Part 1: Specification of Basic notation*.

ISO 10303-1:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 1: Overview and fundamental principles*.

ISO 10303-11:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 11: Description methods: The EXPRESS language reference manual*.

ISO 10303-21:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 21: Implementation methods: Clear text encoding of the exchange structure*.

ISO 10303-31:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 31: Conformance testing methodology and framework: General concepts*.

ISO/WD 10303-226(E)

ISO 10303-41:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 41: Integrated generic resources: Fundamentals of product description and support.*

ISO 10303-42:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 42: Integrated generic resources: Geometric and topological representation.*

ISO 10303-43:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 43: Integrated generic resources: Representation structures.*

ISO 10303-44:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 44: Integrated generic resources: Product structure configuration.*

ISO 10303-45: 1994, *Industrial automation systems and integration — Product data representation and exchange — Part 45: Integrated generic resources: Materials.*

ISO 10303-46:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 46: Integrated generic resources: Visual presentation.*

ISO 10303-49: 1994, *Industrial automation systems and integration — Product data representation and exchange — Part 49: Integrated generic resource: Process structure and properties.*

ISO 10303-101: 1994, *Industrial automation systems and integration — Product data representation and exchange — Part 101: Integrated application resource: Draughting.*

ISO 13584-1: *Industrial automation systems and integration — Parts library — Part 1: Overview and fundamental Principles.*

ISO 13584-42: *Industrial automation systems and integration — Parts library — Part 42: Methodology for Structuring Part Families.*

ISO 7967-1: 1987, *Reciprocating internal combustion engines — Vocabulary of components and systems.*

ISO 2710: 1978, *Reciprocating internal combustion engines - Vocabulary.*

IEC 50 (191): 1990-12, *First Edition, International Electrotechnical Vocabulary, Chapter 191: Dependability and quality of service.*

ISO DIS 14224: 1997, *Petroleum and natural gas industries – Collection and exchange of reliability and maintenance data for equipment.*

ISO 8402: 1986, *Quality – Vocabulary.*

EN 13306: (Draft European Standard): 1998, *Maintenance terminology.*

BS 4778 Part 2: 1991, *Quality concepts and related definitions.*

3 Terms, definitions and abbreviations

3.1 Terms defined in ISO 10303-1

For the purpose of this part of ISO 10303, the following terms defined in ISO 10303-1 apply:

- abstract test suite (ATS);
- application;
- application activity model (AAM);
- application context;
- application interpreted model (AIM);
- application object;
- application protocol (AP);
- application reference model (ARM);
- assembly;
- conformance class;
- conformance requirement;
- conformance testing;
- context;
- data;
- data exchange;
- implementation method;
- information;
- integrated resource;
- interpretation;
- model;
- PICS proforma;
- product;
- product data;

- protocol implementation conformance statement (PICS);
- structure;
- unit of functionality (UoF).

3.2 Terms defined in ISO 10303-31

For the purpose of this part of ISO 10303, the following terms defined in ISO 10303-31 apply:

- conformance testing;
- postprocessor;
- preprocessor.

3.3 Terms defined in ISO 10303-41

For the purpose of this part of ISO 10303, the following terms defined in ISO 10303-41 apply:

- Address;
- Calendar_date;
- Coordinated_universal_time_offset;
- Date;
- Date_and_time;
- Date_role;
- Date_time_role;
- Local_time;
- Ordinal_date;
- Organization;
- Organizational_project;
- Person_and_organization;
- Time_role;
- Week_of_year_and_day_date.

3.4 Terms defined in ISO 10303-42

For the purpose of this part of ISO 10303, the following terms defined in ISO 10303-42 apply:

- Cartesian_point;
- Direction;
- Geometric_representation_item;
- Solid_model;
- Vector.

3.5 Terms defined in ISO 10303-43

For the purpose of this part of ISO 10303, the following terms defined in ISO 10303-43 apply:

- representation.

3.6 Terms defined in ISO DIS 14224

For the purpose of this part of ISO 10303, the following terms defined in ISO DIS 14224 apply:

- adjust;
- check;
- failure mode;
- failure descriptor;
- refit;
- replace.

3.7 Terms defined in IEC 50(191)

For the purpose of this part of ISO 10303, the following terms defined in IEC 50 (191) apply:

- availability;
- availability performance;
- condition monitoring;
- corrective maintenance;
- critical failure;
- downstate;
- failure cause;

- failure rate;
- failure;
- fault;
- logistics delay;
- maintainability;
- maintainability performance;
- maintenance;
- maintenance action;
- maintenance man-hour;
- maintenance time;
- mean availability;
- mean time between failure;
- mean time to failure;
- mean time to repair;
- non-critical failure;
- preventive maintenance;
- reliability (performance);
- reliability and maintainability management;
- repair;
- scheduled maintenance;
- test;
- unscheduled maintenance;
- upstate.

3.8 Terms defined in ISO 8402: 1986

For the purpose of this part of ISO 10303, the following terms defined in ISO 8402 apply:

- condition monitoring;

— inspection.

3.9 Terms defined in Draft EN 13306

For the purpose of this part of ISO 10303, the following terms defined in Draft EN 13306 apply:

— monitoring;
— overhaul.

3.10 Other definitions

For the purposes of this Part of ISO 10303, the following definitions apply:

3.10.1 acquisition code: a code number assigned to a product by a purchaser during the order process.

3.10.2 activity: anything that is carried out by human or by knowledge-based systems on a mechanical product or in relation to a mechanical product.

3.10.3 aft: the location at or near the stern of the ship.

3.10.4 ambient conditions: anything relating to a condition of the environment (see 3.10.39) such as temperature and pressure of the ambient fluid. All the conditions that influence the mechanical product and all the conditions resulting from the mechanical product's function are included.

3.10.5 ambient fluid: a fluid that surrounds a mechanical product.

3.10.6 anomaly: a product problem or enhancement that may result in a change requirement. The product problems are deviations from expected product specification. The product enhancement is a need for improved product specification.

3.10.7 assembly: a composition (see 3.10.19) plus the specification of how the things in the composition are related to each other.

3.10.8 auxiliary system: a system (see 3.10.96) that supports one or more main systems. In ship terminology, auxiliary systems refer to those systems that support the propulsion system.

3.10.9 bilge system: a system (see 3.10.96), comprising pumps, pipes and so on for handling bilge water.

3.10.10 bill of material: a composition (see 3.10.19) plus the identification of all the mechanical products included in the composition.

3.10.11 breakdown maintenance: the maintenance policy for an item for which failures are not prevented using a preventive maintenance (see 3.7) scheme, as the failure of such item is not critical for safety, economy or for the system to carry out its intended function as designed.

3.10.12 cargo handling system: a system (see 3.10.96) whose main function is handling ship cargo.

3.10.13 catalogue: a type of document (see 3.10.34) in printed or electronic format that contains information on one or a set of mechanical products.

3.10.14 class: a concept to group mechanical products, with similar characteristics, with the purpose of describing the common properties of the class members. Each mechanical product belongs to at least one class.

NOTE a class usually has a criterion for inclusion or exclusion of mechanical products.

3.10.15 classification: the process of ensuring that a ship is designed, built and maintained to a prescribed standard.

3.10.16 classification society: an organisation that enhances the safety of life and property at sea by providing rules, regulations and personnel for assessing and classifying ships during their life cycle.

3.10.17 collection: a set of things that do not have any relationship to each other apart from being members of the same set.

3.10.18 component: a mechanical product that is part of another mechanical product and has not already been classified as a system (see 3.10.96) or an equipment (3.10.40). A component cannot have a system or an equipment as part of it.

3.10.19 composition: an association that indicates that one mechanical product is composed of many other mechanical products.

3.10.20 compressed air system: a system (see 3.10.96) that produces compressed air to satisfy the requirements of all mechanical products that require compressed air to perform their function.

3.10.21 compressor: a reciprocating or rotary machinery for raising the pressure of air or another gas.

3.10.22 condition based maintenance: a maintenance to be carried out according to prescribed criteria and after reception of an indication regarding the state of an item, and intended to reduce the probability of failure or the degradation of a mechanical product.

3.10.23 configuration: a data specification that deals with identification, approvals and versioning aspects of a mechanical product or its definitions (see 3.10.32).

3.10.24 connecting component: any intermediary mechanical product including weld, gaskets, bolts, nuts, and so on that are needed in order to realise a connection (see 3.10.25).

3.10.25 connection: an association between two mechanical products that results from a physical joining.

3.10.26 connector: a mechanical product that establishes an interface between two mechanical products or between a mechanical product and other category of items.

NOTE a connector is always part of a mechanical product that is intended to connect to another mechanical product.

3.10.27 connector component: a type of component (see 3.10.18) that plays the role of a connector (see 3.10.26).

3.10.28 control equipment: a non-machinery equipment (see 3.10.40) that is primarily used in the control and monitoring systems.

3.10.29 cooling water system: a system (see 3.10.96) for storing, treating and transporting water at desired temperature, pressure and flowrate to satisfy the requirements of all equipment (see 3.10.40) that require cooling by water.

3.10.30 deck machinery: all types of equipment (see 3.10.40) that are positioned on the ship's deck and perform the operations of mooring, cargo handling and anchor handling including winches, windlasses, capstans, derricks and cranes.

3.10.31 decomposition hierarchy: a systematic breakdown of a mechanical product into its subsystems and components. The decomposition hierarchy for selected mechanical products are documented in Annex M of this part of ISO 10303.

3.10.32 definitions: an aggregation of the information and properties that characterise or describe one or many aspects of a mechanical product.

3.10.33 definitions configuration: a data specification that defines the configuration (see 3.10.23) for a set of definitions (see 3.10.32).

3.10.34 document: any type of information content in the form of manuals, computer files, catalogues, reports, books and so on in standard or non-standard formats.

3.10.35 economiser: an equipment (see 3.10.40) that uses the energy of the exhaust gases leaving the diesel engine to heat water for ship domestic use or as a feedwater preheater for an auxiliary boiler.

3.10.36 electrical equipment: an equipment (see 3.10.40) that is primarily used in an electrical system.

3.10.37 electrical machinery: an electrical equipment (see 3.10.36) with the function as machinery (see 3.10.56).

EXAMPLE electrical motors and generators are examples of electrical machinery.

3.10.38 engineering analysis: an activity carried out, either manually or by computer, either experimentally or theoretically, in order to develop or verify a theory, or to quantify one aspect of the mechanical product behaviour.

3.10.39 environment: anything external to a mechanical product that has a bearing on function and usage of the mechanical product.

3.10.40 equipment: a mechanical product that carries out a generally self contained function and to a large extent may be treated as a single mechanical product for the purpose of design, acquisition, or operation. An equipment has both physical and functional properties.

EXAMPLE a turbocharger is an equipment. A pump is also an equipment.

3.10.41 event and approval data: a set of data that relates to an event (see 3.10.42) and its approval/authorisation.

3.10.42 event: a state which identifies that something has happened at a certain time. A person normally causes the event.

3.10.43 fore: that part of the ship which is at the front of the ship.

3.10.44 fresh water: the processed water on-board ship that is used for utilities.

3.10.45 fuel oil system: a system (see 3.10.96) for storing, treating, and transporting liquid fuel to equipment (see 3.10.40) that requires fuel to perform its function.

3.10.46 functional: a reference to the actions, activities, or capabilities that a mechanical product provides or may provide to fulfil a purpose.

3.10.47 functional characteristics: nomenclature, codes, and named values that describe or specify the performance or behaviour of a mechanical product.

EXAMPLE typical functional characteristics of a diesel engine are its speed-power relationships. Typical pump characteristics are its head-flowrate relationships.

3.10.48 functional specifications: nomenclature, codes, and named values that describe or specify the performance or behaviour to be met by a mechanical product.

3.10.49 general characteristics: the most general and most widely used information relating to a mechanical product.

3.10.50 inertia: the tendency of a body rotating about a fixed axis to resist a change in this rotating motion. Normally referred to as moment of inertia.

3.10.51 item: any part, component, subsystem, functional unit, equipment, or system of a ship that can be individually considered. The item refers to all the mechanical, electrical, structural, and other physical elements as well as non-physical aspects such as tasks, faults, failures and so on.

3.10.52 life cycle status: the product data that specify where in its lifecycle the product is.

3.10.53 liquid impurity: any type of liquid, at low concentrations, that is part of the composition of a liquid, normally with some harmful effect on the use of the liquid for a specific purpose.

3.10.54 log: a structured record capturing specified sets of information at given ship events (see 3.10.42) or at specified time intervals. Deck and engine logs are normally required by law.

3.10.55 lube oil system: a piping system (see 3.10.71) for supplying lubricant at the desired temperature and pressure and flowrate to equipment (see 3.10.40) that requires lubrication.

3.10.56 machinery: a reciprocating or rotating equipment that performs some sort of energy conversion as its underlying function.

3.10.57 manoeuvring system: a system (see 3.10.96) used to perform planned movement or change from the straight, steady course and speed of a ship or to maintain the vessel in a given stationary location and heading.

3.10.58 mechanical connector: a connector (see 3.10.26) that is primarily used for connecting mechanical equipments together.

3.10.59 mechanical equipment: a non-machinery equipment that is primarily used in mechanical systems. Gear boxes and couplings are examples of mechanical equipment.

3.10.60 mechanical machinery: a machinery (see 3.10.56) that is primarily used in mechanical systems.

EXAMPLE all kinds of reciprocating and rotary engines are examples of mechanical machinery.

3.10.61 mechanical product: any item (see 3.10.51) of the ship mechanical systems that is realisable as a physical thing. A mechanical product has both physical and functional properties.

3.10.62 mechanical system: a system (see 3.10.96) that is within the scope (see 1) of this part of ISO 10303.

3.10.63 mechanical transmission system: a system (see 3.10.96) by which motive power from the prime mover is made available and matched to load. Shafting system connecting main engine to

propeller, or shafting system connecting auxiliary engine to electric generators are examples of mechanical transmission systems.

3.10.64 members of composition: those mechanical products that appear at the first decomposition level of the decomposition hierarchy (see 3.10.31). The members of composition within this part of ISO 10303 are those specified in Annex M.

3.10.65 metallic impurity: any type of trace metal that is part of the composition of a liquid, normally with some harmful effect on the use of the liquid for a specific purpose.

3.10.66 mounting: a connection (see 3.10.25), rigid or flexible, between an equipment (see 3.10.40) and the ship's structure.

3.10.67 part: any mechanical product at the atomic (lowest composition) level.

3.10.68 physical: a reference term which refers to shape and material characteristics such as weight, size, and location of the mechanical product.

3.10.69 piping connector: a connector (see 3.10.26) that is primarily used in a piping system for connecting piping equipment or piping parts to each other.

3.10.70 piping equipment: a non-machinery equipment that is primarily used in a piping system. Valves are examples of piping equipment.

3.10.71 piping system: a system (see 3.10.96) composed of pipes, valves, pumps/compressors, and so on with the main function of transporting and distributing fluids.

3.10.72 plan: any type of dimensional drawing of a mechanical product.

3.10.73 port: a type of connector (see 3.10.26) that enables a flow of energy, load, process material or signal to or from another mechanical product.

3.10.74 power system: a system (see 3.10.96) that supplies mechanical energy for the operation of another system.

3.10.75 process equipment: an equipment (see 3.10.40) that is primarily used in a process plant for carrying out certain processes.

EXAMPLE heat exchangers, filters and purifiers are examples of process equipment.

3.10.76 product configuration: a data specification that defines the configuration (see 3.10.23) of a mechanical product for the purpose of managing/controlling current status and historical changes of the product.

3.10.77 product connectivity: a data specification that defines all aspects of product connections (see 3.10.25) in relation to external systems and equipments.

3.10.78 product structure: a data specification that defines the following in relation to a mechanical product: i) the system for which the mechanical product is a part, ii) the items that are part of the mechanical product, and iii) the position and location of a mechanical product.

3.10.79 propulsion system: a system (see 3.10.96), comprising of prime movers, shafting systems and propulsors, that produces the required thrust for the ship movement using and converting fuel energy.

3.10.80 propulsor: a powered equipment that sets up a thrust on the water to enable a ship to move in a controlled direction.

EXAMPLE propeller is an example of a propulsor.

3.10.81 pump-jet propulsor: a pump system that accelerates large volumes of water, drawn in from beneath the ship, and expels it as a high speed jet, setting up a sufficient reaction force to propel the ship. The pump impeller is mounted with a vertical axis.

3.10.82 reliability, availability and maintainability (RAM) analysis: an engineering analysis (see 3.10.38) activity with the objective of defining the RAM characteristic (see 3.10.83) of mechanical products.

3.10.83 reliability, availability and maintainability (RAM) characteristics: a set of product-related properties that specifies the reliability, availability and maintainability properties of a product.

3.10.84 reciprocating machinery: a machinery (see 3.10.56) that works according to reciprocating motion.

3.10.85 rotating machinery: a machinery (see 3.10.56) that works according to rotating motion.

3.10.86 schematic presentation: a type of drawing that conveys information about relationships among things by the relative physical position of symbols.

3.10.87 screw propeller: a revolving boss with blades that are usually set at an angle and twisted like the threads of a screw. When the propeller is rotated in the water, a column of water passes through it, gaining momentum. The reactive force which arises is taken up by the thrust bearing in the transmission system, enabling the ship to move.

3.10.88 ship mechanical system: a mechanical system (see 3.10.62) that provides or performs, or is intended to provide or perform, a service or function contributing to or enabling the operation of a ship.

3.10.89 ship mooring system: a system (see 3.10.96) whose main function is to secure a ship in open water.

3.10.90 ship operation: all activities required by ship operator and onboard crew to enable the intended services of the ship.

NOTE in this application protocol the main emphasis is on the technical aspect of the ship operation. The ship operation phase within the ship lifecycle starts when the ship is commissioned and ends when the ship is scrapped.

3.10.91 solid model: a geometric representation of a mechanical product and deals mainly with external geometries including shape, volume, area and so on.

3.10.92 spatial arrangements: the location, orientation and relative position of the components of a mechanical system.

3.10.93 steam generation system: a system (see 3.10.96) that converts water into steam.

3.10.94 steam power system: a power system (see 3.10.74) with a steam turbine as prime mover.

3.10.95 steering mechanism: a system (see 3.10.96) that provides the means of manoeuvring the ship under normal service conditions.

3.10.96 system: an assembly of one or more items (see 3.10.51), with functional and physical relationships between them, that performs or can perform a clearly identified function as a whole. A system may have both physical and functional properties.

3.10.97 task: anything that is carried out by a human on a mechanical product or in relation to a mechanical product. Each task has a clear beginning and ending.

3.10.98 time based maintenance: the maintenance to be carried out at predetermined intervals intended to reduce the probability of failure or the degradation of an item.

3.10.99 tunnel thruster: a propulsor (see 3.10.80) consisting of a propeller mounted in a fixed tunnel in the ship's structure.

NOTE tunnel thrusters are normally used as auxiliary thrust units and are provided to facilitate manoeuvres in tight waters. Bow thruster units on a ferry are examples of tunnel thruster.

3.11 Abbreviations

For the purposes of this Part of ISO 10303, the following abbreviations apply.

AAM	application activity model
AIM	application interpreted model
ARM	application reference model
AP	application protocol
BMEP	brake mean effective pressure
BSFC	brake specific fuel consumption
CAD	computer aided design
CFD	computational fluid dynamics
FEA	finite element analysis
IDEF0	integrated definition method
IMEP	indicated mean effective pressure
MP	mechanical product
PICS	protocol implementation conformance statement
RAM	reliability, availability and maintainability
SI	système international
UoF	units of functionality

4 Information requirements

This clause specifies the information required for the exchange of ship's mechanical systems data.

The information requirements are specified as a set of units of functionality, application objects, and application assertions. These assertions pertain to individual application objects and to relationships between application objects. The information requirements are defined using the terminology of the subject area of this application protocol.

NOTE 1 a graphical representation of the information requirements is given in annex G.

NOTE 2 the information requirements correspond to those of the activities identified as being in the scope of this application protocol in annex F.

NOTE 3 the mapping table is specified in 5.1 which shows how the information requirements are met using the integrated resources of this International Standard. The use of the integrated resources introduces additional requirements which are common to all application protocols.

4.1 Units of functionality

This subclause specifies the units of functionality for the Ship's Mechanical Systems application protocol. This Part of ISO 10303 specifies the following units of functionality:

- configuration_definitions;
- connecting_components;
- connector_components
- control_components;
- cranes;
- date_and_time;
- diesel_engines;
- electric_power_generation_systems;
- electrical_machineries;
- external_references;
- external_resources_requirements;
- failures;
- faults;
- gas_turbine_engines;
- gear_boxes;
- generic_components;
- generic equipments;
- heat_exchangers;
- local_co_ordinate_systems;
- machineries;
- machinery_piping_systems;
- maintenance_tasks;
- material_properties
- materials;
- measure_with_units;
- mechanical_components;
- mechanical equipments;
- mechanical_product_anomalies;
- mechanical_product_connections;

- mechanical_product_definitions;
- mechanical_product equipments;
- mechanical_product_properties;
- mechanical_product_representations;
- mechanical_product_structures;
- mechanical_product_systems;
- mechanical_products;
- other equipments;
- other_systems;
- part_library_references;
- part41_resources;
- part42_resources;
- piping_components;
- process equipments;
- process_machineries;
- procurement_definitions;
- product_connection_general_characteristics;
- pumps;
- RAM_characteristics;
- rotating_components;
- screw_propellers;
- shafts;
- ship_voyages
- ships;
- task_definitions;
- tasks;
- time_and_events.

The units of functionality and a description of the functions that each UoF supports are given below. The application objects included in the UoFs are defined in clause 4.2.

4.1.1 configuration_definitions

The configuration_definitions UoF specifies the concepts for keeping high level records and information relating to product identification and its usage context. Concepts such as associating the product to contracts/projects and assigning the ownership of product are supported. The configuration_definitions UoF also supports the life cycle identification of a mechanical product and whether a mechanical product represents a conceptual, designed, planned or a real thing.

NOTE 1 product configuration (see 3.10.76) is independent of its definitions' configuration (see 3.10.33). However, it may reference data relating to definitions' configuration.

NOTE 2 the tracking of mechanical product status within its lifecycle is within the scope of this UoF.

NOTE 3 the concepts required to uniquely identify a mechanical product and its classification are out of scope of this UoF.

NOTE 4 the concepts required to support configuration management activities such as versioning, change control and approval of version or change are out of scope of this UoF.

The following application objects are used by the configuration_definitions UoF:

- Configuration_definition;
- Product_context;
- Product_identification;
- Product_status.

4.1.2 connecting_components

The connecting_components UoF specifies the type classification for mechanical components that are used to realise a connection (see 3.10.25).

The following application objects are used by the connecting_components UoF:

- Bolt;
- Chock;
- Connecting_component;
- Nut;
- Pin;
- Rod;
- Seal;
- Structural_item.

4.1.3 connector_components

The connector_components UoF specifies the type classification for mechanical components that are used as connectors (see 3.10.26).

The following application objects are used by the connector_components UoF:

- Bearing_element;
- Bedplate;
- Cable_end;
- Connector_component;
- Electrical_connector;
- Hinge;
- Mechanical_connector;
- Piping_connector;
- Piping_item_end;
- Plug;
- Shaft_end;
- Shaft_journal;
- Socket;
- Structural_connector;
- Welded_end.

4.1.4 control_components

The control_components UoF specifies the type classification for mechanical components that are used primarily in a control system or perform some control function.

The following application objects are used by the control_components UoF:

- Control_component;

- Flowrate_sensor;
- Gauge;
- Pressure_sensor;
- Sensor;
- Speed_sensor;
- Temperature_sensor;
- Torque_sensor.

4.1.5 cranes

The cranes UoF specifies the structure for associating all the relevant definitions (see 3.10.32) to a crane.

NOTE 1 this UoF inherits all the generic crane-related definitions.

NOTE 2 this UoF is always used in connection with other UoFs which associate description, approval details, identification data and other definitions to cranes.

NOTE 3 the information on systems, equipment and components which are part of a crane is outside the scope of this UOF.

The following application objects are used by the cranes UoF:

- Crane;
- Crane_ambient_condition;
- Crane_composition;
- Crane_connectivity;
- Crane_context;
- Crane_design_characteristic;
- Crane_drawing;
- Crane_general_characteristic;
- Crane_identification;
- Crane_load_characteristic;
- Crane_mass_weight_inertia;
- Crane_operational_characteristic;
- Crane_overall_dimension;
- Crane_placement;
- Crane_stability_data;
- Crane_status;
- Lifting_equipment.

4.1.6 date_and_time

The date_and_time UoF specifies the application objects which are in ISO10303-41 and are used by this part of ISO 10303.

The following application objects are used by the date_and_time UoF:

- Calendar_date;
- Coordinated_universal_time_offset;
- Date;
- Date_and_time;
- Date_role;

- Date_time_role;
- Local_time;
- Ordinal_date;
- Time_role;
- Week_of_year_and_day_date.

4.1.7 diesel_engines

The diesel_engines UoF specifies the structure for associating the relevant definitions (see 3.10.32) to a diesel engine.

NOTE 1 this UoF inherits all the generic diesel engine related definitions.

NOTE 2 this UoF is always used in connection with other UoFs which associate description, approval details, identification data and other definitions to diesel engines.

NOTE 3 the information on systems, equipment and components which are part of a diesel engine is out of scope of this UoF.

The following application objects are used by the diesel_engines UoF:

- Diesel_engine;
- Diesel_engine_composition;
- Diesel_engine_connectivity;
- Diesel_engine_context;
- Diesel_engine_cylinder_data;
- Diesel_engine_design_characteristic;
- Diesel_engine_drawing;
- Diesel_engine_fuel_injection_data;
- Diesel_engine_general_characteristic;
- Diesel_engine_identification;
- Diesel_engine_mass_weight_inertia;
- Diesel_engine_operational_characteristic;
- Diesel_engine_operational_performance_data;
- Diesel_engine_overall_dimension;
- Diesel_engine_overall_operational_data;
- Diesel_engine_performance_data;
- Diesel_engine_placement;
- Diesel_engine_status;
- Fuel_injection_dynamic_data.

4.1.8 electric_power_generation_systems

The electric_power_generation_systems UoF specifies the type classification for systems that are used to generate electrical energy by converting fuel energy.

The following application objects are used by the electric_power_generation_systems UoF:

- Combined_cycle_plant;
- Diesel_electric_plant;
- Electric_power_generation_system;
- Gas_turbine_plant;
- Shaft_generator_system;
- Steam_power_plant.

4.1.9 electrical_machineries

The electrical_machineries UoF specifies the type classification and characteristics for electric motors and generators.

The following application objects are used by the electrical_machineries UoF:

- Electric_generator;
- Electric_generator_design_characteristic;
- Electric_generator_general_characteristic;
- Electric_generator_operational_characteristic;
- Electric_motor;
- Electric_motor_design_characteristic;
- Electric_motor_general_characteristic;
- Electric_motor_operational_characteristic;
- Electrical_machinery.

4.1.10 external_references

The external_references UoF specifies an external reference mechanism to assign additional documentation in electronic or non-electronic form to the product, task/activity or definitions. The external_references UoF also facilitates access to information, standard or non-standard, on ship mechanical systems that are outside the scope of this part of ISO 103030.

NOTE 1 all types of user manuals, computer files, catalogues, reports, books and so on are considered as external documents and are in the scope of this UoF.

NOTE 2 the referencing of external databases and data libraries, standard or non-standard, are in the scope of this UoF.

NOTE 3 the referencing of the ISO 13584 compliant libraries is outside the scope of this UoF and is covered in part_library_references UoF (see 4.1.39).

The following application objects are used by the external_references UoF:

- Document;
- Document_reference;
- External_instance_reference;
- External_mechanical_product_definition;
- External_reference;
- External_reference_inside_source;
- Global_unique_identifier.

4.1.11 external_resources_requirements

The external_resources_requirements UoF specifies the framework for classification and grouping of all the data that are attributable to equipment's utility requirements such as cooling water, electricity and fuel.

NOTE the information in the form of documentation is in the scope of this UoF.

The following application objects are used by the external_resources_requirements UoF:

- Electrical_requirement;
- External_resources_requirement;
- Fluid_material_requirement;
- Gas_material_requirement;
- Liquid_material_requirement;
- Material_requirement;
- Mechanical_product_external_resources_requirement;
- Solid_material_requirement;
- Spare_parts_requirement.

4.1.12 failures

The failures UoF specifies the concept for associating the relevant definitions (see 3.10.32) to a failure (see 3.7).

The following application objects are used by the failures UoF:

- Failure;
- Failure_cause;
- Failure_configuration_data;
- Failure_criticality;
- Failure_effect;
- Failure_fault_relationship;
- Failure_time_and_date.

4.1.13 faults

The faults UoF specifies the concept for associating the relevant definitions (see 3.10.32) to a fault (see 3.7).

The following application objects are used by the faults UoF:

- Fault;
- Fault_cause;
- Fault_configuration_data;
- Fault_criticality;
- Fault_effect;
- Fault_time_and_date.

4.1.14 gas_turbine_engines

The gas_turbine_engines UoF specifies the data structure for associating the relevant definitions (see 3.10.32) to a gas turbine engine.

NOTE 1 this UoF inherits all the gas turbine related generic data from other relevant UoFs.

NOTE 2 this UoF is always used in connection with other UoFs which associate description, approval details, identification data and other definitions to gas turbine engines.

NOTE 3 the information on systems, equipment and components which are part of a gas turbine engine is out of scope of this UoF.

The following application objects are used by the `gas_turbine_engines` UoF:

- `Gas_turbine_engine`;
- `Gas_turbine_engine_composition`;
- `Gas_turbine_engine_connectivity`;
- `Gas_turbine_engine_context`;
- `Gas_turbine_engine_design_characteristic`;
- `Gas_turbine_engine_drawing`;
- `Gas_turbine_engine_general_characteristic`;
- `Gas_turbine_engine_identification`;
- `Gas_turbine_engine_mass_weight_inertia`;
- `Gas_turbine_engine_operational_characteristic`;
- `Gas_turbine_engine_operational_performance_data`;
- `Gas_turbine_engine_overall_dimension`;
- `Gas_turbine_engine_overall_operational_data`;
- `Gas_turbine_engine_performance_data`;
- `Gas_turbine_engine_placement`;
- `Gas_turbine_engine_status`.

4.1.15 gear_boxes

The `gear_boxes` UoF specifies the concept for associating the relevant definitions (see 3.10.32) to a gear box.

The following application objects are used by the `gear_boxes` UoF:

- `Gear_box`;
- `Gear_box_composition`;
- `Gear_box_connectivity`;
- `Gear_box_design_characteristic`;
- `Gear_box_drawing`;
- `Gear_box_general_characteristic`;
- `Gear_box_identification`;
- `Gear_box_mass_weight_inertia`;
- `Gear_box_operational_characteristic`;
- `Gear_box_overall_dimension`.

4.1.16 generic_components

The `generic_components` UoF specifies the concept for associating the relevant definitions (see 3.10.32) to a generic component. The concept of generic component is used in this part of ISO 10303 to represent typical mechanical components and facilitates the exchange of generic data at specification or procurement phase of product life cycle.

The following application objects are used by the `generic_components` UoF:

- `Generic_component`;
- `Generic_component_identification`;
- `Generic_component_mass_weight_inertia`.

4.1.17 generic equipments

The generic equipments UoF specifies the concept for associating the relevant definitions (see 3.10.32) to a generic equipment. The concept of generic equipment is used in this part of ISO 10303 to represent typical mechanical equipment and facilitates the exchange of generic data at specification or procurement phase of product life cycle.

The following application objects are used by the generic equipments UoF:

- Generic_equipment;
- Generic_equipment_dimensional_characteristic;
- Generic_equipment_general_characteristic;
- Generic_equipment_identification;
- Generic_equipment_mass_weight_inertia;
- Generic_measure_with_unit.

4.1.18 heat_exchangers

The heat_exchangers UoF specifies the structure for associating the relevant definitions (see 3.10.32) to a heat exchanger.

NOTE 1 this UoF inherits all the heat exchanger related generic data from other relevant UoFs.

NOTE 2 this UoF is always used in connection with other UoFs which associate description, approval details, identification data and other definitions to heat exchangers.

NOTE 3 the information on components which are part of a heat exchanger is out of scope of this UoF.

The following application objects are used by the heat_exchangers UoF:

- Heat_exchanger;
- Heat_exchanger_composition;
- Heat_exchanger_connectivity;
- Heat_exchanger_context;
- Heat_exchanger_design_characteristic;
- Heat_exchanger_drawing;
- Heat_exchanger_general_characteristic;
- Heat_exchanger_identification;
- Heat_exchanger_mass_weight_inertia;
- Heat_exchanger_operational_characteristic;
- Heat_exchanger_operational_performance_data;
- Heat_exchanger_overall_dimension;
- Heat_exchanger_performance_data;
- Heat_exchanger_placement;
- Heat_exchanger_status.

4.1.19 local_co_ordinate_system

The local_co_ordinate_systems UoF specifies location of a mechanical product within the coordinate system.

The following application objects are used by the local_co_ordinate_systems UoF:

- Local_co_ordinate_system.

4.1.20 machineries

The machineries UoF specifies the type classification and structure for associating the relevant definitions (see 3.10.32) to a machinery (see 3.10.56).

The following application objects are used by the machineries UoF:

- Compressor;
- Machinery;
- Machinery_composition;
- Machinery_design_characteristic;
- Machinery_general_characteristic;
- Machinery_utility_requirement;
- Mechanical_machinery;
- Reciprocating_machinery;
- Rotating_machinery.

4.1.21 machinery_piping_systems

The machinery_piping_systems UoF specifies the concept for defining type classification for all piping systems that are used in relation to ship machinery.

NOTE 1 the definition of piping system connectivity and topological details are outside the scope of this UoF.

NOTE 2 this UoF mainly facilitates a black box representation of a piping system and is mainly used for representing the general characteristics of the piping systems that are related or integrated to machinery systems.

NOTE 3 the design and manufacturing details of the machinery piping systems are outside the scope of this UoF.

The following application objects are used by the machinery_piping_systems UoF:

- Cooling_air_system;
- Cooling_system;
- Cooling_water_system;
- Fuel_injection_system;
- Fuel_supply_system;
- Lubrication_system.

4.1.22 maintenance_tasks

The maintenance_tasks UoF specifies the concept for associating the relevant definitions (see 3.10.32) to a maintenance task.

NOTE 1 this UoF inherits all the maintenance task related definitions.

NOTE 2 this UoF is always used in association with other task related UoFs which associate description, approval details, identification data and other definitions to a maintenance task.

The following application objects are used by the maintenance_tasks UoF:

- Maintenance_configuration_data;
- Maintenance_cost;
- Maintenance_failure_relationship;
- Maintenance_human_resource;
- Maintenance_item;
- Maintenance_item_relationship;
- Maintenance_logistic_delay;
- Maintenance_procedure;
- Maintenance_result;
- Maintenance_schedule;
- Maintenance_spare_part;
- Maintenance_task;
- Maintenance_tool.

4.1.23 material_properties

The material_properties UoF specifies the type classification and grouping of all the properties of materials that are used within the scope of this part of ISO 10303.

The following application objects are used by the material_properties UoF:

- Element_content;
- Fluid_chemical_property;
- Fluid_physical_property;
- Gas_chemical_property;
- Gas_physical_property;
- Impurity_name_and_content;
- Liquid_chemical_property;
- Liquid_physical_property;
- Material_chemical_property;
- Material_composition;
- Material_impurities_definition;
- Material_physical_property;
- Material_property;
- Solid_chemical_property;
- Solid_physical_property.

4.1.24 materials

The materials UoF specifies the type classification for various types of materials used in relation to a mechanical product.

NOTE the material from which the product is made, equipment's working fluids and ambient fluids are in the scope of this UoF.

The following application objects are used by the materials UoF:

- Fluid_material;
- Gas_material;
- Liquid_material;
- Material;

- Mechanical_product_ambient_fluid;
- Solid_material.

4.1.25 **measure_with_units**

The measure_with_units UoF specifies the concept for representing measures for physical quantities together with their units.

The following application objects are used by the measure_with_units UoF:

- Density;
- Dilatation;
- Electrical_current;
- Energy;
- Energy_per_mass;
- Force;
- Frequency;
- Heat_capacity;
- Inertia_moment;
- Length;
- Linear_damping_coefficient;
- Linear_stiffness;
- Mass;
- Mass_flow;
- Measure_with_unit;
- Molecular_weight;
- Plane_angle;
- Power;
- Pressure;
- Ratio;
- Rotational_damping_coefficient;
- Rotational_speed;
- Rotational_stiffness;
- Specific_fuel_consumption;
- Speed;
- Stress;
- Surface_tension;
- Temperature;
- Thermal_conductivity;
- Time;
- Torque;
- Viscosity;
- Voltage;
- Volume_flow.

4.1.26 **mechanical_components**

The mechanical_components UoF specifies the type hierarchy and related data objects for those mechanical products that are classified as mechanical components.

The following application objects are used by the mechanical_components UoF:

- Balance_weight;
- Bearing_element;
- Brake_pad;
- Connecting_rod;
- Crankcase;
- Crankshaft_web;
- Crosshead_pin;
- Cylinder;
- Cylinder_liner;
- Equipment_casing;
- Exhaust_manifold;
- Fuel_injector;
- Intake_manifold;
- Mechanical_component;
- Piston;
- Rudder;
- Shaft_brake;
- Tension_rod;
- Valve_cage.

4.1.27 mechanical equipments

The mechanical equipments UoF specifies the type hierarchy and related data objects for those mechanical products that are classified as mechanical equipment (see 3.10.59).

The following application objects are used by the mechanical equipments UoF:

- Clutch;
- Damper;
- Flexible_coupling;
- Fluid_coupling;
- Gear_box;
- Mechanical_equipment;
- Mechanical_governor;
- Shaft_coupling;
- Silencer;
- Solid_coupling.

4.1.28 mechanical product anomalies

The mechanical product anomalies UoF specifies the concept and framework for type hierarchy and grouping of different types of engineering information relating to product anomaly (see 3.10.6).

NOTE 1 the definition of tasks in order to rectify the product anomaly is outside the scope of this UoF.

NOTE 2 the classification and identification of type of anomaly are within the scope of this UoF.

The following application objects are used by the mechanical product anomalies UoF:

- Anomaly_cause;
- Anomaly_configuration;
- Anomaly_criticality;
- Anomaly_effect;

- Anomaly_time_and_date;
- Design_anomaly;
- Operation_anomaly;
- Product_anomaly;
- Product_anomaly_definition.

4.1.29 mechanical_product_connections

The mechanical_product_connections UoF specifies the type classification and data objects for all types of physical connections between mechanical products.

NOTE 1 this UoF is used to specify the type of connection. Engineering data and specifications for the connection is out of scope of this UoF and is covered in product_connection_general_characteristics UoF (see 4.1.46).

NOTE 2 identification of all the mechanical products which take part in realising the physical connection is in the scope of this UoF.

The following application objects are used by the mechanical_product_connections UoF:

- Electrical_connection;
- Mechanical_connection;
- Mechanical_product_connection.
- Piping_connections;
- Product_connection;
- Structural_connections.

4.1.30 mechanical_product_definitions

The mechanical_product_definitions UoF specifies the high level concept and framework for type hierarchy and grouping of all the engineering information (descriptions and properties) which are attributable to mechanical products.

NOTE 1 the information in the form of documentation is within the scope of this UoF.

NOTE 2 the information on identifying a mechanical product, its structure and its configuration are outside the scope of this UoF.

NOTE 3 the product data and information needed in support of or resulting from lifecycle engineering activities and tasks, carried out in relation to mechanical products, are outside the scope of this UoF.

The following application objects are used by the mechanical_product_definitions UoF:

- Definable_object;
- Definition;
- Definition_relationship;
- Design_characteristic;
- Engineering_analysis_definition;
- Functional_characteristic;
- Geometric_definition;
- Manufacturing_characteristic;
- Mass_weight_inertia;
- Operational_characteristic;
- Overall_dimension;

- Physical_definition;
- Product_QA_requirement;
- Product_material;
- Revision;
- Tolerance.

4.1.31 mechanical_product equipments

The mechanical_product equipments specifies the high-level concept for representing the class of equipment (see 3.10.40) and association of the relevant definitions (see 3.10.32) to this class.

NOTE 1 this UoF is always used in connection with other UoFs which associate definitions to equipment.

NOTE 2 this UoF is used by all mechanical products that are classified as equipment (see 3.10.40).

The following application objects are used by the mechanical_product equipments UoF:

- Equipment_design_characteristic;
- Equipment_general_characteristic;
- Equipment_identification;
- General_identifier;
- Licence_detail;
- Mechanical_product_equipment;
- Model_and_name_plate_data.

4.1.32 mechanical_product properties

The mechanical_product properties UoF specifies the data objects that are referenced by the majority of the specialised UoFs. This UoF is the central place for defining the specific property resource objects that are used by this part of ISO 10303.

NOTE this UoF is always used by other UoFs that reference this UoF's objects.

The following application objects are used by the mechanical_product properties UoF:

- Ambient_condition;
- Counter;
- Cylinder_dynamic_data;
- Equipment_location_condition;
- Equipment_operation_status;
- Exhaust_emission;
- Fluid_flow_data;
- Machinery_overall_operational_data;
- Machinery_performance_data;
- Mechanical_power_transmission_data;
- Mechanical_product_property;
- Power_unit_general_characteristic;
- Product_environment.

4.1.33 mechanical_product representations

The `mechanical_product_representations` UoF specifies the concept for the representation of mechanical product's detailed geometric definitions in the form of shape representation (solid model) and drawing. The `mechanical_product_representations` UoF also facilitates the exchange of identification information on drawings, in addition to the exchange of drawing itself.

NOTE 1 definition of the internal geometry of mechanical products is outside the scope of this UoF.

NOTE 2 information on drawings for identification purposes and association of a drawing to a mechanical product is within the scope of this UoF.

The following application objects are used by the `mechanical_product_representations` UoF:

- `Axis2_placement`;
- `CAD_system`;
- `External_drawing`;
- `External_shape_representation`;
- `Mechanical_product_drawing`;
- `Mechanical_product_representation`;
- `Mechanical_product_shape_representation`;
- `Plib_defined_shape_representation`.

4.1.34 `mechanical_product_structures`

The `mechanical_product_structures` UoF defines the internal composition (see 3.10.19), external participation (being part of something else), connectivity, position and orientation of mechanical products. The `mechanical_product_structures` UoF provides the ability to exchange description of the position of a mechanical product and its arrangement.

NOTE 1 this UoF is always used in conjunction with the `mechanical_products` UoF for which composition, participation, connectivity and placement need to be defined.

NOTE 2 the placement and position of the mechanical product may be something such as a compartment or side of a ship.

NOTE 3 the precise position of the mechanical products in terms of ship co-ordinate system is within the scope of this UoF.

NOTE 4 the composition of mechanical products will be supported in terms of mechanical product hierarchical decomposition, as developed and documented within this part of ISO 10303 (see Annex M).

NOTE 5 the connectivity of mechanical product to its boundary mechanical products and ship structures are facilitated by inclusion of connectors (see 3.10.26) within the internal composition of mechanical products. However, the definition of a physical connection (see 3.10.25) is outside the scope of this UoF and is supported by the `mechanical_product_connections` UoF (see 4.1.29).

The following application objects are used by the `mechanical_product_structures` UoF:

- `Product_assemblage`;
- `Product_composition`;
- `Product_connectivity`;
- `Product_participation`;
- `Product_placement`;
- `Product_structure_definition`;
- `Ship_space`.

4.1.35 mechanical_product_systems

The mechanical_product_systems UoF specifies the concept for associating the relevant definitions (see 3.10.32) to a mechanical system (see 3.10.62).

NOTE 1 this UoF inherits all the generic system's related definitions.

NOTE 2 this UoF is always used in association with other UoFs which associate description, approval details, identification data and other definitions to a mechanical system.

The following application objects are used by the mechanical_product_systems UoF:

- Azimuth_thruster;
- Control_and_monitoring_system;
- Electrical_system;
- Machinery_piping_system;
- Manoeuvring_system;
- Mechanical_system;
- Mechanical_system_design_characteristic;
- Mechanical_system_general_characteristic;
- Mechanical_transmission_system;
- Propulsion_system;
- Steam_generation_system;
- Mechanical_transmission_system_design_characteristic;
- Propulsion_system_general_characteristic;
- Pump_test_propulsor;
- Water_jet_propulsor.

4.1.36 mechanical_products

The mechanical_products UoF specifies the concept for defining the type hierarchy and classification of mechanical products (see 3.10.61) in a compatible way to other ship APs.

NOTE 1 this UoF does not provide any extra information about the mechanical product other than its existence, context within which it is used and its functionality.

NOTE 2 this UoF is always used in connection with other UoFs which associate description, approval, identification data and other definitions to a mechanical product.

The following application objects are used by the mechanical_products UoF:

- Item;
- Item_relationship;
- Item_structure;
- Mechanical_product;
- Mechanical_product_component;
- Mechanical_product_relationship.

4.1.37 other equipments

The other equipments UoF specifies the type classification for those items of equipment (see 3.10.40) that are in the scope of this part of ISO 10303 but have not been defined in other UoFs.

NOTE 1 this UoF does not provide any extra information about the items of equipment other than their existence and type of equipment.

NOTE 2 this UoF is always used in connection with other UoFs which associate description, approval, identification data and other definitions to the mechanical equipments UoF.

The following application objects are used by the other equipments UoF.

- Actuator;
- Analyser;
- Control_equipment;
- Electrical_equipment;
- Motor_starter;
- Piping_equipment;
- Pressure_vessel;
- Signal_conditioner;
- Switch_board;
- Tank;
- Transformer;
- Valve.

4.1.38 other_systems

The other_systems UoF specifies the type classification for systems that are within scope of this part of ISO 10303 but have not been defined in other UoFs.

The following application objects are used by the other_systems UoF:

- Alarm_system;
- Condition_monitoring_system;
- Data_logging_system;
- Electrical_transmission_system;
- Exhaust_gas_treatment_system;
- Oil_mist_detection_system;
- Rudder_system;
- Safety_system;
- Starting_system;
- Steering_control_mechanism;
- Steering_system.

4.1.39 part_library_references

The part_library_references UoF specifies the data structure for externally referencing an ISO 15358 compliant supplier library.

The following application objects are used by the part_library_references UoF:

- Binary_value;
- Boolean_value;
- BSU;
- Class_BSU;
- Grouped_property;
- Integer_value;

- Library_class_identifier;
- Library_element_reference;
- Library_property_and_property_value;
- Logical_value;
- Number_value
- Plib_definition;
- Plib_mechanical_product;
- Property_BSU
- Property_value;
- Real_value;
- String_value;
- Supplier_BSU;
- The_value;
- Value_list.

4.1.40 part41_resources

The part41_resources UoF specifies all the application objects which are in ISO10303-41 and are used by this part of ISO 10303.

The following application objects are used by the part41_resources UoF:

- Address;
- Date;
- Date_and_time;
- Label;
- Organization;
- Organizational_project;
- Person;
- Person_and_organization;
- Text.

4.1.41 part42_resources

The part42_resources UoF specifies all the application objects which are in ISO10303-42 and are used by this part of ISO 10303.

The following application objects are used by the part42_resources UoF:

- Cartesian_point;
- Direction;
- Geometric_representation_item;
- Solid_model;
- Vector.

4.1.42 piping_components

The piping_components UoF specifies the type classification for the components (see 3.10.18) of piping system (see 3.10.71) or piping equipment (see 3.10.70).

The following application objects are used by the piping_components UoF:

- Duct;

- Expansion_joint;
- Fitting;
- Pipe;
- Piping_component;
- Piping_component_design_characteristic;
- Piping_component_operational_characteristic;
- Tunnel.

4.1.43 process equipments

The process equipments UoF specifies the concept for defining type classification for process equipment (see 3.10.75).

The following application objects are used by the process equipments UoF:

- Condenser;
- De_aerator;
- De_oiler;
- Ejector;
- Filter;
- Process_equipment.

4.1.44 process machineries

The process machineries UoF specifies the type classification for machinery (see 3.10.56) primarily used in a process plant.

The following application objects are used by the process machineries UoF:

- Agitator;
- Centrifuge;
- Clarifier;
- Homogeniser;
- Process_machinery;
- Purifier;
- Separator.

4.1.45 procurement definitions

The procurement_definitions UoF specifies the data structures for part and equipment procurement.

NOTE this UoF is always used in connection with other UoFs that associates procurement data to mechanical products.

The following application objects are used by the procurement_definitions UoF:

- Delivery;
- Delivery_definition;
- Order_definition;
- Price;
- Price_and_date;
- Price_definition;
- Procurement_definition;

- Stock_definition.

4.1.46 product_connection_general_characteristics

The product_connection_general_characteristics UoF specifies the data structures that define the general characteristics of a mechanical connection.

NOTE this UoF is always used in connection with other UoFs that contain the resource objects that are referenced by this UoF.

The following application objects are used by the product_connection_general_characteristics UoF:

- Electrical_connection_general_characteristic;
- Mechanical_connection_general_characteristic;
- Piping_connection_general_characteristic;
- Product_connection_general_characteristic;
- Structural_connection_general_characteristic.

4.1.47 pumps

The pumps UoF specifies the data structure for associating the relevant definitions (see 3.10.32) to a pump.

NOTE 1 this UoF inherits all the pump related generic data from other relevant UoFs.

NOTE 2 this UoF is always used in connection with other UoFs which associate description, approval details, identification data and other definitions to pumps.

NOTE 3 the information on systems, equipment and components which are part of a pump is out of scope of this UoF.

The following application objects are used by the pumps UoF:

- Pump;
- Pump_composition;
- Pump_connectivity;
- Pump_context;
- Pump_design_characteristic;
- Pump_drawing;
- Pump_general_characteristic;
- Pump_identification;
- Pump_mass_weight_inertia;
- Pump_operational_characteristic;
- Pump_operational_performance_data;
- Pump_overall_dimension;
- Pump_performance_data;
- Pump_placement;
- Pump_status.

4.1.48 RAM_characteristics

The RAM_characteristics UoF specifies the concept for collecting the data and information relating to mechanical product's reliability, availability and maintainability characteristics (see 3.10.83).

NOTE the procedures for calculating or recording the RAM-related data are outside the scope of this UoF.

The following application objects are used by the RAM_characteristics UoF:

- Availability_characteristic;
- Maintainability_characteristic;
- RAM_characteristic;
- Reliability_characteristic.

4.1.49 rotating_components

The rotating_components UoF specifies the type classification for components (see 3.10.18) that work according to rotating motion.

The following application objects are used by the rotating_components UoF:

- Bearing;
- Camshaft;
- Crank_shaft;
- Flywheel;
- Gear_stage;
- Gear_wheel;
- Impeller;
- Rotating_component;
- Rotating_component_operational_characteristic;
- Shaft;
- Turning_gear.

4.1.50 screw_propellers

The screw_propellers UoF specifies the concept for associating the relevant definitions (see 3.10.32) to screw propellers (see 3.10.87).

NOTE 1 this UoF inherits all the screw propeller related generic definitions.

NOTE 2 this UoF is always used in connection with other UoFs which associate description, approval details, identification data and other definitions to screw propellers .

NOTE 3 the information on systems, equipments and components which are part of a screw propeller is outside the scope of this UoF.

The following application objects are used by the screw_propellers UoF:

- Screw_propeller;
- Screw_propeller_composition;
- Screw_propeller_connectivity;
- Screw_propeller_context;
- Screw_propeller_design_characteristic;
- Screw_propeller_drawing;
- Screw_propeller_general_characteristic;
- Screw_propeller_identification;
- Screw_propeller_mass_weight_inertia;

- Screw_propeller_operational_characteristic;
- Screw_propeller_operational_performance_data;
- Screw_propeller_overall_dimension;
- Screw_propeller_performance_data;
- Screw_propeller_placement;
- Screw_propeller_status.

4.1.51 shafts

The shafts UoF specifies the structure for associating the relevant definitions (see 3.10.32) to a shaft.

The following application objects are used by the shafts UoF:

- Shaft;
- Shaft_connectivity;
- Shaft_design_characteristic;
- Shaft_drawing;
- Shaft_general_characteristic;
- Shaft_identification;
- Shaft_mass_weight_inertia;
- Shaft_operational_characteristic;
- Shaft_overall_dimension;
- Shaft_placement;
- Vibration_characteristic;
- Vibration_properties.

4.1.52 ship_voyages

The ship_voyages UoF specifies the data structures for defining the ship voyage including ports visited, shipyard stays, seas and time schedule and delays.

The following application objects are used by the ship_voyages UoF:

- Restricted_water;
- Sea;
- Sea_port;
- Ship_port_relationship;
- Ship_restricted_water_relationship;
- Ship_sea_relationship;
- Ship_shipyard_relationship;
- Ship_voyage;
- Shipyard.

4.1.53 ships

The ships UoF specifies the information required to describe the ship. All ship product data are defined independent of the ship and have a reference to it. The ships UoF describes the essential information to permit that reference. The applications objects in this UoF are common to all ship related APs.

The following application objects are used by the ships UoF:

- Class_parameters;

- Principal_characteristics;
- Ship;
- Ship_designation;
- Ship_general_characteristic;
- Ship_operation_characteristic;
- Ship_overall_dimensions;
- Shipyard_designation.

4.1.54 task_definitions

The task_definitions UoF specifies the framework for type hierarchy and grouping of all the data and information which are attributable to tasks (see 3.10.97).

NOTE 1 the information in the form of documentation is in the scope of this UoF.

NOTE 2 the information relating to task configuration, procedures, schedules and required resources are in the scope of this UoF.

The following application objects are used by the task_definitions UoF:

- Human_resource;
- Spare_part;
- Task_approval;
- Task_configuration;
- Task_cost;
- Task_definition;
- Task_delay;
- Task_other_resource;
- Task_procedure;
- Task_request_detail;
- Task_resource;
- Task_result;
- Task_schedule;
- Tool.

4.1.55 tasks

The tasks UoF specifies the type classification for all the tasks (see 3.10.97) that are carried out in relation to mechanical products for which data are needed to be exchanged. Concepts for relating tasks to each other and identification of major aspects of relationship are also supported by the tasks UoF.

NOTE 1 this UoF does not provide any extra information about a task other than its existence and its identification.

NOTE 2 this UoF is normally used in connection with other task-related UoFs which associate description, approval and definitions to a tasks.

The following application objects are used by the tasks UoF:

- Analysis_task;
- Design_task;
- Operation_task;
- Survey_inspection_task;
- Task;

- Task_relationship;
- Test_task.

4.1.56 time_and_events

The time_and_events UoF specifies the concept for describing the events and their authorisation and approval. All the events which take place during the various stages of ship life cycle are in the scope of the time_and_events UoF.

The following application objects are used by the time_and_events UoF:

- Approval_event;
- General_event;
- Time_period;
- Time_schedule.

4.2 Application objects

This subclause specifies the application objects for the ship mechanical systems application protocol. Each application object is an atomic element that embodies a unique application concept and contains attributes specifying the data elements of the object. The application objects and their definitions are given below.

4.2.1 Actuator

An Actuator is a type of Control_equipment (see 4.2.44) and specifies the concept for all the actuators that need to be defined. An actuator is any device that is moved a predetermined distance in order to operate or control another mechanical device.

The data associated with an Actuator are the following:

- actuator_type.

4.2.1.1 actuator_type

The actuator_type specifies the type of the actuator.

The value of actuator_type shall be one of the following:

- electric;
- hydraulic;
- manual;
- pneumatic.

4.2.1.1.1 electric: the descriptor that specifies that the actuator uses electric energy for its operation.

4.2.1.1.2 hydraulic: the descriptor that specifies that the actuator uses hydraulic power for its operation.

4.2.1.1.3 manual: the descriptor that specifies that the actuator is manually operated.

4.2.1.1.4 pneumatic: the descriptor that specifies that the actuator uses pneumatic pressure for its operation.

4.2.2 Address

An Address specifies postal data associated with a person or organisation. It is used as defined in ISO 10303-41.

4.2.3 Agitator

An Agitator is a type of Process_machinery (see 4.2.374) and specifies the concept for all the agitators that need to be defined. An agitator is a mechanical device used to maintain fluidity and plasticity, and to prevent segregation of liquids and solids in liquids.

4.2.4 Alarm_system

An Alarm_system is a type of Mechanical_system (see 4.2.326) and specifies the concept for defining all the alarm systems that need to be defined. An alarm system provides an alternative means of warning to the operator if abnormal operating conditions are detected in the equipment.

4.2.5 Ambient_condition

An Ambient_condition is a type of Mechanical_product_property (see 4.2.322) that specifies data relating to the ambient conditions of a mechanical product.

The data associated with an Ambient_condition are the following:

- ambient_pressure;
- ambient_temperature;
- other_conditions.

4.2.5.1 ambient_pressure

The ambient_pressure specifies the pressure of the ambient fluid.

4.2.5.2 ambient_temperature

The ambient_temperature specifies the temperature of the ambient fluid.

4.2.5.3 other_conditions

The other_conditions specifies and describes other ambient conditions for the product in text format.

4.2.6 Analyser

An Analyser is a type of Control_equipment (see 4.2.44) and specifies the concept for all the analysers that need to be defined. An analyser is an instrument system, usually composed of a number of basic instruments, that is used for making electronic measurements.

The data associated with an Analyser are the following:

- analyser_type;

The analyser_type specifies, as text, the type of the analyser.

4.2.7 Analysis_task

An Analysis_task is a type of Task (see 4.2.511) and specifies the concept for representing data that are attributable to an analysis task. Within this part of ISO 10303, an analysis task is a type of engineering analysis (see 3.10.38).

The data associated with an Analysis_task are the following:

- type_of_task.

The `type_of_task` specifies, as text, the type of analysis task.

4.2.8 Anomaly_cause

An `Anomaly_cause` is a type of `Product_anomaly_definition` (see 4.2.377) and specifies the concept for defining all the data relating to the causes of an anomaly. Within this part of ISO 10303 each `Anomaly_cause` is either a `Failure_cause` (see 4.2.150) or a `Fault_cause` (see 4.2.157).

The data associated with an `Anomaly_cause` are the following:

- `cause_descriptor`;
- `defined_for`.

4.2.8.1 cause_descriptor

The `cause_descriptor` specifies, as text, a detailed description of the cause of the anomaly.

4.2.8.2 defined_for

The `defined_for` specifies a set of one to many product anomalies for which the cause is defined.

4.2.9 Anomaly_configuration_data

An `Anomaly_configuration_data` is a type of `Product_anomaly_definition` (see 4.2.377) and specifies the concept for defining the data relating to the identification and classification of an anomaly. Within this part of ISO 10303 each `Anomaly_configuration_data` is either a `Failure_configuration_data` (see 4.2.151) or a `Fault_configuration_data` (see 4.2.158).

The data associated with an `Anomaly_configuration_data` are the following:

- `defined_for`.

The `defined_for` specifies a set of one to many product anomalies for which configuration data are defined.

4.2.10 Anomaly_criticality

An `Anomaly_criticality` is a type of `Product_anomaly_definition` (see 4.2.377) and specifies the concept for defining the data that describe criticality aspects of an anomaly. Within this part of ISO 10303 each `Anomaly_criticality` is either a `Failure_criticality` (see 4.2.152) or a `Fault_criticality` (see 4.2.159).

The data associated with an `Anomaly_criticality` are the following:

- `defined_for`.

The `defined_for` specifies a set of one to many product anomalies for which criticality is defined.

4.2.11 Anomaly_effect

An `Anomaly_effect` is a type of `Product_anomaly_definition` (see 4.2.377) and specifies the concept for defining the data that describe effects of an anomaly. Within this part of ISO 10303 each `Anomaly_effect` is either a `Failure_effect` (see 4.2.153) or a `Fault_effect` (see 4.2.160).

The data associated with an `Anomaly_effect` are the following:

- `defined_for`.

The `defined_for` specifies a set of one to many product anomalies for which the effects are defined.

4.2.12 Anomaly_time_and_date

An `Anomaly_time_and_date` is a type of `Product_anomaly_definition` (see 4.2.377) that specifies the high level concept for defining time details as related to an anomaly. Within this part of ISO 10303 each `Anomaly_time_and_date` is either a `Failure_time_and_date` (see 4.2.155) or a `Fault_time_and_data` (see 4.2.161).

The data associated with an `Anomaly_time_and_date` are the following:

- `date_and_time_anomaly_discovered`;
- `date_and_time_anomaly_happened`;
- `date_and_time_anomaly_rectified`;
- `defined_for`.

4.2.12.1 date_and_time_anomaly_discovered

The `date_and_time_anomaly_discovered` specifies the date and time at which the anomaly has been discovered.

4.2.12.2 date_and_time_anomaly_happened

The `date_and_time_anomaly_happened` specifies the date and time at which the anomaly has occurred.

4.2.12.3 date_and_time_anomaly_rectified

The `date_and_time_anomaly_rectified` specifies the date and time at which the anomaly has been rectified.

4.2.12.4 defined_for

The `defined_for` specifies a set of one to many product anomalies for which time and date have been defined.

4.2.13 Approval_event

An `Approval_event` is a type of `General_event` (see 4.2.214) and specifies an approval or authorisation event.

The data associated with an `Approval_event` are the following:

- `approval_status`.

4.2.13.1 approval_status

The approval_status specifies the result of the approval activity.

The value of approval_status shall be one of the following:

- approved;
- noted;
- rejected;
- unapproved.

4.2.13.1.1 approved: the descriptor which specifies that the approval event has led to acceptance of the subject matter.

4.2.13.1.2 noted: the descriptor which specifies that the need for an approval decision for a subject matter has been identified.

4.2.13.1.3 rejected: The descriptor which specifies that the subject matter has been rejected.

4.2.13.1.4 unapproved: the descriptor which specifies that the subject matter is in the process of being reviewed by the organisation responsible for approval.

4.2.14 Availability_characteristic

An Availability_characteristic is a type of RAM_characteristic (see 4.2.413) and specifies the data which are attributable to availability performance (see 3.7) of a mechanical product.

The data associated with an Availability_characteristic are the following:

- availability;
- duration_of_down-time;
- duration_of_up_time;
- related_time_data;
- total_duration.

4.2.14.1 availability

The availability specifies the mean availability (see 3.7) for an equipment.

4.2.14.2 duration_of_down_time

The duration_of_down_time specifies the expected duration for an equipment to be in a downstate (see 3.7). The duration_of_down_time is derived from total_duration and availability.

4.2.14.3 duration_of_up_time

The duration_of_up_time specifies the expected duration for an equipment to be in an upstate (see 3.7). The duration_of_up_time is derived from total_duration and availability.

4.2.14.4 related_time_data

The related_time_data specifies a set of zero to many time values that needs to be specified in order to clarify the time context of the availability characteristics. There may be more than one related_time_data for an Availability_characteristic.

4.2.14.5 total_duration

The total_duration specifies the total duration of time for which availability performance information is specified.

4.2.15 Azimuth_thruster

An Azimuth_thruster is a type of Mechanical_system (see 4.2.326) and specifies the concept for defining all the azimuth thrusters that need to be defined. An azimuth thruster is a propulsor (see 3.10.80) consisting of a propeller driven from a vertical shaft, which may rotate about its vertical axis, thereby enhancing the steerage of a vessel.

4.2.16 Balance_weight

A Balance_weight is a type of Mechanical_component (see 4.2.306) and specifies the concept for all the balance weights that need to be defined. A balance weight is a lumped mass of material added to a rotating shaft or component to counteract the forces that cause unbalance and vibration.

4.2.17 Bearing

A Bearing is a type of Rotating_component (see 4.2.421) and specifies the concept for all the bearings that need to be defined. A bearing is a mechanical device for supporting a rotating load.

The data associated with a Bearing are the following:

— bearing_type.

4.2.17.1 bearing_type

The bearing_type specifies the type of the bearing.

The value of bearing_type shall be one of the following:

- big_end_bearing;
- crank_pin_bearing;
- cross_head_bearing;
- journal_bearing;
- small_end_bearing;
- user_defined_bearing_type.

4.2.17.1.1 big_end_bearing: the descriptor that specifies the bearing is a journal bearing by which the connecting rod is attached to the crank pin on the crankshaft.

4.2.17.1.2 crank_pin_bearing: the descriptor which specifies that the bearing is a crank pin bearing of a diesel engine.

4.2.17.1.3 cross_head_bearing: the descriptor which specifies that the bearing is a cross head bearing of a diesel engine.

4.2.17.1.4 journal_bearing: the descriptor which specifies that the bearing is of type journal bearing.

4.2.17.1.5 small_end_bearing: the descriptor that specifies the bearing is a journal bearing by which the connecting rod is attached to the crosshead pin or the gudgeon pin.

4.2.17.1.6 user_defined_bearing_type: the descriptor, set by the user, that specifies the type of the bearing if different from the other options.

4.2.18 Bearing_element

A **Bearing_element** is a type of **Mechanical_connector** (see 4.2.309) and specifies the concept for all the bearing elements that need to be defined. A bearing element is the surface within a bearing that supports the rotating load. It is normally lubricated and often rotates itself.

4.2.19 Bedplate

A **Bedplate** is a type of **Structural_connector** (see 4.2.503) and specifies the concept for all the equipment bedplates that need to be defined. Within this part of ISO 10303, a bedplate is considered as part of the equipment and serves as its base and is used for fixing the equipment to a structure.

4.2.20 Binary_value

The **Binary_value** specifies that the property value is of type binary.

The data associated with a **Binary_value** are the following:

— the_value;

The the_value specifies the actual value of the property in the form of a binary number (a number comprising of zeros and ones).

4.2.21 Bolt

A **Bolt** is a type of **Connecting_component** (see 4.2.39) and specifies the concept for all the bolts that need to be defined. A bolt in conjunction with a **Nut** (see 4.2.337) is used for fixing mechanical products.

4.2.22 Boolean_value

The **Boolean_value** specifies that the property value is of type boolean.

The data associated with a **Boolean_value** are the following:

— the_value.

The the_value specifies the actual value of the property in the form of a boolean number (zero or one).

4.2.23 Brake_pad

A Brake_pad is a type of Mechanical_component (see 4.2.306) and specifies the concept for all the brake pads that need to be defined. A brake pad is a component that provides lining on its outside surface that comes into frictional contact with the brake disk.

4.2.24 BSU

A BSU (Basic Semantic Unit – as defined in ISO 13584-42) specifies the information needed for referencing the content of an ISO 13584 compliant data dictionary.

The data associated with a BSU are the following:

- code;
- version.

4.2.24.1 code

The code specifies, as text, the unique code assigned to the BSU.

4.2.24.2 version

The version specifies, as text, the version number of the BSU.

4.2.25 Cable_end

A Cable_end is a type of Electrical_connector (see 4.2.121) and specifies the concept for all the cable ends that need to be defined. Within this part of ISO 10303, a cable end is the end part of an electric cable that is used for connecting the cable to a device.

4.2.26 Camshaft

A Camshaft is a type of Rotating_component (see 4.2.421) and specifies the concept for all the camshafts that need to be defined. A camshaft is a rotating shaft to which a number of cams are fastened and used to actuate the fuel pump or cylinder valves.

The data associated with a Camshaft are the following:

- the_type.

The the_type specifies, as text, the type of the camshaft.

4.2.27 Cartesian_point

A Cartesian_point specifies a point defined by its coordinates in a rectangular Cartesian coordinate system, or in a parameter space. The entity is defined in a one, two or three-dimensional space as determined by the number of coordinates in the list. It is used as defined in ISO 10303-42.

4.2.28 Centrifuge

A Centrifuge is a type of Process_machinery (see 4.2.374) and specifies the concept for all the centrifuges that need to be defined. A centrifuge is a rotating device that uses centrifugal force to separate substances of different densities.

4.2.29 Chock

A Chock is a type of Connecting_component (see 4.2.39) and specifies the concept for all the chocks that need to be defined. Chocks are used, amongst other items, to secure equipment to ship structure.

4.2.30 Clarifier

A Clarifier is a type of Process_machinery (see 4.2.374) and specifies the concept for all the clarifiers that need to be defined. A clarifier is a device that clears a liquid from suspended particles through filtration or centrifugation.

4.2.31 Class_BSU

A Class_BSU is a type of BSU (see 4.2.24) and specifies the identification information for referencing a mechanical product as defined in an ISO 13584 compliant data dictionary.

The data associated with a Class_BSU are the following:

- delivered_by.

The delivered_by specifies the supplier of the ISO 13584 compliant data library.

4.2.32 Class_parameters

A Class_parameters is a type of Ship_general_characteristic (see 4.2.472) and specifies the length and speed of the ship in accordance with the classification society rules and statutory regulations.

The data associated with Class_parameters are the following:

- block_coefficient_class;
- defined_for;
- design_speed_ahead;
- design_speed_astern;
- froude_number;
- length_class;
- length_solas;
- scantlings_draught.

4.2.32.1 block_coefficient_class

The block_coefficient_class specifies the ratio of the moulded displacement volume to the volume of a block that has its length equal to the length_class, its breadth equal to the moulded_breadth and its depth equal to the scantlings_draught. The block_coefficient_class need not be specified for a particular Class_parameter.

4.2.32.2 defined_for

The defined_for specifies a set of one to many ships for which class parameters are defined.

4.2.32.3 design_speed_ahead

The design_speed_ahead specifies the forward speed at which the ship is designed to operate.

4.2.32.4 design_speed_astern

The design_speed_astern specifies the reverse speed at which the ship is designed to operate.

4.2.32.5 froude_number

The froude_number specifies the ship froude number that is of significance to the resistance and propulsion calculations of a ship. The Froude number is a nondimensional parameter that is defined by dividing the ship speed in meter per second by the square root of the product of the length of the ship in meter and the gravitational acceleration in meter per square second. In the DERIVE clause the design_speed_ahead for the ship speed and the length_class for the length of the ship are used.

4.2.32.6 length_class

The length_class specifies the ship length as is defined in classification society rules.

4.2.32.7 length_solas

The length_solas specifies the length measurement for the ship in accordance with the International Convention on the Safety of Life at Sea.

4.2.32.8 scantlings_draught

The scantlings_draught specifies the summer load draught used by the classification society in its calculations for structural integrity and strength.

4.2.33 Clutch

A Clutch is a type of Mechanical_equipment (see 4.2.310) and specifies the concept for all the clutches that need to be defined. A clutch is any device for engagement or disengagement of mechanical power. A clutch is normally part of a mechanical transmission system.

The data associated with a Clutch are the following:

— clutch_type.

4.2.33.1 clutch_type

The clutch_type specifies the type of the clutch.

The value of clutch_type shall be one of the following:

— electro_magnetic;

- hydraulic;
- pneumatic.

4.2.33.1.1 electro_magnetic: the descriptor that specifies that the clutch uses electromagnetic forces to engage/disengage.

4.2.33.1.2 hydraulic: the descriptor that specifies that the clutch uses hydraulic power to engage/disengage.

4.2.33.1.3 pneumatic: the descriptor that specifies that the clutch uses pneumatic pressure to engage/disengage.

4.2.34 Combined_cycle_plant

A `Combined_cycle_plant` is a type of `Electric_power_generation_system` (see 4.2.118)and specifies the concept for defining all the combined cycle plants that are used for generating electrical energy. The combined cycle plants normally comprise of a mix of diesel engines, gas turbines and steam turbines.

4.2.35 Compressor

A `Compressor` is a type of `Rotating_machinery` (see 4.2.423) and specifies the concept for defining all the rotary compressors (see 3.10.21) that need to be defined.

4.2.36 Condenser

A `Condenser` is a type of `Process_equipment` (see 4.2.373) and specifies the concept for all the condensers that need to be defined. A condenser is a heat transfer equipment consisting of an array of tubes into which the exhaust steam from a steam engine is distributed and condensed by the circulation of cooling water through the tubes.

4.2.37 Condition_monitoring_system

A `Condition_monitoring_system` is a type of `Mechanical_system` (see 4.2.326) and specifies the concept for defining all the condition monitoring systems that need to be defined. A condition monitoring system records and processes salient operating data from an equipment so that trends in its performance characteristics can be assessed for appropriate action to avoid failures.

4.2.38 Configuration_definition

A `Configuration_definition` is a type of `Definition` (see 4.2.77) and specifies the high level concept for all the data relating to the configuration (see 3.10.23) of a mechanical product. Within this part of ISO 10303 a `Configuration_definition` is either a `Product_context` (see 4.2.383), a `Product_identification` (see 4.2.385) or a `Product_status` (see.4.2.390).

4.2.39 Connecting_component

A `Connecting_component` is a type of `Mechanical_product_component` (see 4.2.316) and specifies the concept for all the connecting components (see 3.10.24) that need to be defined. Within this part of ISO 10303, each `Connecting_component` is either a `Bolt` (see 4.2.21), a `Chock` (see 4.2.29), a `Nut` (see 4.2.337), a `Pin` (see 4.2.349), a `Rod` (see 4.2.420), a `Seal` (see 4.2.447), or a `Structural_item` (see 4.2.504).

4.2.40 Connecting_rod

A Connecting_rod is a type of Mechanical_component (see 4.2.306) and specifies the concept for all the connecting rods of a reciprocating machinery that need to be defined. A connecting rod is a nearly cylindrical bar that connects the piston or crosshead to the crank shaft in a reciprocating pump or engine.

4.2.41 Connector_component

A Connector_component is a type of Mechanical_product_component (see 4.2.316) and specifies the concept for all the connector components (see 3.10.27) that need to be defined. Within this part of ISO 10303, each Connector_component is either a Piping_connector (see 4.2.356), a Structural_connector (see 4.2.503), a Mechanical_connector (see 4.2.309), or an Electrical_connector (see 4.2.121).

4.2.42 Control_and_monitoring_system

A Control_and_monitoring_system is a type of Mechanical_system (see 4.2.326) that specifies the concept for all the ship control and monitoring systems which need to be defined or described.

The data associated with a Control_and_monitoring_system are the following:

— type_of.

The type_of specifies, as text, the type of control and monitoring system.

4.2.43 Control_component

A Control_component is a type of Mechanical_product_component (see 4.2.316) and specifies the concept for all the control components that need to be defined. Within this part of ISO 10303, each Control_component is either a Sensor (see 4.2.448) or a Gauge (see 4.2.201).

4.2.44 Control_equipment

A Control_equipment is a type of Mechanical_product_equipment (see 4.2.319) and specifies the concept for defining all the control equipment (see 3.10.28) that need to be defined. Within this part of ISO 10303, each Control_equipment is either an Analyser (see 4.2.6), an Actuator (see 4.2.1), or a Signal_conditioner (see 4.2.479).

4.2.45 Cooling_air_system

A Cooling_air_system is a type of Cooling_system (see 4.2.46) and specifies the concept for defining all the heat transfer systems that are used for cooling the process air.

4.2.46 Cooling_system

A Cooling_system is a type of Machinery_piping_system (see 4.2.277) and specifies the concept for defining all the heat transfer systems that are used for cooling process fluids. Within this part of ISO 10303, each Cooling_system is either a Cooling_water_system (see 4.2.47) or a Cooling_air_system (see 4.2.45).

4.2.47 Cooling_water_system

A Cooling_water_system is a type of Cooling_system (see 4.2.46) and specifies the concept for defining all the heat transfer systems that are used for reducing the water temperature.

4.2.48 Counter

A Counter is a type of Mechanical_product_property (see 4.2.322) and specifies the concept for representing all the counters that need to be defined. A counter is a device that registers and totals the number of operations performed by a machine.

The data associated with a Counter are the following:

- counter_unit;
- counter_value.

4.2.48.1 counter_unit

The counter_unit specifies the unit that is to be used with the value produced by the counter.

The value of the counter_unit shall be one of the following:

- hours;
- revolution;
- user_defined.

4.2.48.1.1 hours: the descriptor that specifies the counter unit is hour.

4.2.48.1.2 revolution: the descriptor that specifies the counter unit is shaft revolution.

4.2.48.1.3 user_defined: the descriptor, set by the user, that specifies the counter unit if different from the other options.

4.2.48.2 counter_value

The counter_value specifies the number represented by the counter.

4.2.49 Crane

A Crane is a type of Lifting_equipment (see 4.2.261) and specifies the concept for all the cranes that need to be defined. A crane is a power-operated hoisting machine with lifting and pivoted boom that allows movement of loads horizontally as well as vertically.

The data associated with a Crane are the following:

- crane_type.

The crane_type specifies the type of crane.

4.2.49.1 crane_type

The value of crane_type shall be one of the following:

- deck_crane;
- user_defined_crane.

4.2.49.1.1 deck_crane: the descriptor which specifies that the crane is located at the ship's deck.

4.2.49.1.2 user-defined_crane: the descriptor, set by the user, if type of crane is different from the other options.

4.2.50 Crane_ambient_condition

A Crane_ambient_condition is a type of Ambient_condition (see 4.2.5) that specifies the ambient conditions (see 3.10.4) for a crane.

The data associated with a Crane_ambient_condition are the following:

- wind_speed.

The wind_speed specifies the wind speed for which the crane has been designed or under which the crane is operated.

4.2.51 Crane_composition

A Crane_composition is a type of Product_composition (see 4.2.379) that specifies the composition (see 3.10.19) data which are attributable to all types of cranes.

The data associated with a Crane_composition are the following:

- defined_for;
- equipment_list.

4.2.51.1 defined_for

The defined_for specifies a set of one to many cranes for which the composition is defined. There may be more than one defined_for for a Crane_composition.

4.2.51.2 equipment_list

The equipment_list specifies the particulars of all the equipment which is part of a crane. There may be more than one equipment_list for a Crane_composition.

4.2.52 Crane_connectivity

A Crane_connectivity is a type of Product_connectivity (see 4.2.382) and specifies the connectivity of a crane in terms of its connections to the other mechanical products at its boundary.

The data associated with a Crane_connectivity are the following:

- defined_for.

The defined_for specifies a set of one to many cranes for which connectivity is defined.

4.2.53 Crane_context

A Crane_context is a type of Product_context (see 4.2.383) and specifies the context, such as ship context and project context, within which the crane is used or considered.

The data associated with a Crane_context are the following:

- defined_for.

The defined_for specifies a set of one to many cranes for which context is defined.

4.2.54 Crane_design_characteristic

A Crane_design_characteristic is a type of Equipment_design_characteristic (see 4.2.133) and specifies the functional characteristics (see 3.10.47) which are attributable to design aspects of cranes.

The data associated with a Crane_design_characteristic are the following:

- braking_time;
- defined_for;
- design_ambient_condition;
- hoisting_speed;
- lifting_capacity;
- lifting_height;
- luffing_time;
- nature_of_lifting_operation;
- slewing_speed;
- stability_data.

4.2.54.1 braking_time

The braking_time specifies the crane hoisting braking time.

4.2.54.2 defined_for

The defined_for specifies a set of one to many cranes for which the design characteristics are defined. There may be more than one defined_for for a Crane_design_characteristic.

4.2.54.3 design_ambient_condition

The design_ambient_condition specifies the crane ambient condition such as pressure, temperature and wind speed for which the crane is designed.

4.2.54.4 hoisting_speed

The hoisting_speed specifies the crane hoisting speed in terms of speed by which the nominal load can be hoisted. There may be more than one hoisting_speed for a Crane_design_characteristic.

4.2.54.5 lifting_capacity

The lifting_capacity specifies the crane lifting capacity in terms of nominal weight it can handle.

4.2.54.6 lifting_height

The `lifting_height` specifies the crane characteristics in terms of the height to which a load could be lifted.

4.2.54.7 luffing_time

The `luffing_time` specifies the crane luffing time for raising the jib from its minimum angle to its maximum angle.

4.2.54.8 nature_of_lifting_operation

The `nature_of_lifting_operation` specifies, as text, the duty cycle and other operational constraints under which the crane will be operated.

4.2.54.9 slewing_speed

The `slewing_speed` specifies the crane slewing speed.

4.2.54.10 stability_data

The `stability_data` specifies the crane-related stability data by referencing the `Crane_stability_data` (see 4.2.63) application object. There may be more than one `stability_data` for a `Crane_design_characteristic`.

4.2.55 Crane_drawing

A `Crane_drawing` is a type of `Mechanical_product_drawing` (see 4.2.318) and specifies the concept for associating various types of drawings to a crane.

The data associated with a `Crane_drawing` are the following:

- `defined_for`.

The `defined_for` specifies a set of one to many cranes for which drawing is defined.

4.2.56 Crane_general_characteristic

A `Crane_general_characteristic` is a type of `Equipment_general_characteristic` (see 4.2.134) and specifies the concept for all the general characteristics (see 3.10.49) data which are attributable to all types of cranes.

The data associated with a `Crane_general_characteristic` are the following:

- `defined_for`;
- `jib_parking_arrangements`.

4.2.56.1 defined_for

The `defined_for` specifies a set of one to many cranes for which the general characteristics are defined. There may be more than one `defined_for` for a `Crane_general_characteristic`.

4.2.56.2 jib_parking_arrangements

The jib_parking_arrangements specifies, as text, the parking arrangement for the jib when the crane is not in use.

4.2.57 Crane_identification

A Crane_identification is a type of Equipment_identification (see 4.2.135) and specifies the data for identification of the crane.

The data associated with a Crane_identification are the following:

- defined_for.

The defined_for specifies a set of one to many cranes for which identification is defined.

4.2.58 Crane_load_characteristic

A Crane_load_characteristic is a type of Engineering_analysis_definition (see 4.2.131) that specifies the principal forces/loads which act on a crane.

The data associated with a Crane_load_characteristic are the following:

- defined_for;
- forces_due_to_wind;
- forces_dynamic;
- forces_ship_inclination;
- loads_dead;
- loads_live;
- loads_on_platform;
- loads_snow_and_ice.

4.2.58.1 defined_for

The defined_for specifies a set of one to many cranes for which the load characteristics are defined. There may be more than one defined_for for a Crane_load_characteristic.

4.2.58.2 forces_due_to_wind

The forces_due_to_wind specifies the total force acting on the crane due to wind.

4.2.58.3 forces_dynamic

The forces_dynamic specifies the total force acting on the crane due to crane dynamics.

4.2.58.4 forces_ship_inclination

The forces_ship_inclination specifies the total force acting on the crane due to the ship heel and trim.

4.2.58.5 loads_dead

The loads_dead specifies the total force acting on the crane due to the crane weight.

4.2.58.6 loads_live

The loads_live specifies the total force acting on the crane due to the hoisting load.

4.2.58.7 loads_on_platform

The loads_on_platform specifies the total force acting on the ship deck which supports the crane, as a result of the weight of the crane.

4.2.58.8 loads_snow_and_ice

The loads_snow_and_ice specifies the total expected maximum force due to snow and ice.

4.2.59 Crane_mass_weight_inertia

A Crane_mass_weight_inertia is a type of Mass_weight_inertia (see 4.2.297) and specifies the mass, weight and inertia for the crane.

The data associated with a Crane_mass_weight_inertia are the following:

- defined_for.

The defined_for specifies a set of one to many cranes for which mass, weight and inertia are defined.

4.2.60 Crane_operational_characteristic

A Crane_operational_characteristic is a type of Operational_characteristic (see 4.2.341) and specifies a high level concept for all the crane-related operational data.

The data associated with a Crane_operational_characteristic are the following:

- defined_for;
- operation_ambient_conditions.

4.2.60.1 defined_for

The defined_for specifies a set of one to many cranes for which operational characteristics are defined.

4.2.60.2 operation_ambient_conditions

The operation_ambient_conditions specifies ambient conditions under which a crane is operating.

4.2.61 Crane_overall_dimension

A Crane_overall_dimension is a type of Overall_dimension (see 4.2.345) and defines the overall dimensions which are attributable to all types of cranes.

The data associated with a Crane_overall_dimension are the following:

- defined_for;
- jib_angle_max;

- jib_angle_min;
- jib_radius_max;
- jib_radius_min.

4.2.61.1 defined_for

The defined_for specifies a set of one to many cranes for which the overall dimensions are defined.

4.2.61.2 jib_angle_max

The jib_angle_max specifies the maximum angle of elevation of the crane jib.

4.2.61.3 jib_angle_min

The jib_angle_min specifies the minimum angle of elevation of the crane jib.

4.2.61.4 jib_radius_max

The jib_radius_max specifies the maximum radius of the crane jib from the slewing axis.

4.2.61.5 jib_radius_min

The jib_radius_min specifies the minimum radius of the crane jib.

4.2.62 Crane_placement

A Crane_placement is a type of Product_placement (see 4.2.388) and specifies the position of the crane on the ship in terms of ship compartment and co-ordinate system.

The data associated with a Crane_placement are the following:

- defined_for.

The defined_for specifies a set of one to many cranes for which placement is defined.

4.2.63 Crane_stability_data

A Crane_stability_data specifies the data which define the stability characteristics of a crane.

The data associated with a Crane_stability_data are the following:

- overturning_moment;
- qualifier;
- stability_moment.

4.2.63.1 overturning_moment

The overturning_moment specifies the moment that causes crane overturning.

4.2.63.2 qualifier

The qualifier specifies, as text, additional information relating to crane stability.

4.2.63.3 stability_moment

The `stability_moment` specifies the maximum moment under which a crane will remain operationally stable.

4.2.63.4 Date_and_time

A `Date_and_time` specifies the combined calendar date and the day time. It is used as defined in ISO 10303-41.

4.2.64 Crane_status

A `Crane_status` is a type of `Product_status` (see 4.2.390) and specifies the status of a crane in terms of its life-cycle phase.

The data associated with a `Crane_status` are the following:

— `defined_for`.

The `defined_for` specifies a set of one to many cranes for which status is defined.

4.2.65 Crank_shaft

A `Crank_shaft` is a type of `Rotating_component` (see 4.2.421) and specifies the concept for all the crank-shafts that need to be defined. A crank-shaft is a structure composed of a series of throws offset at angles from each other around a central axis. The crank-shaft converts reciprocating motion of the piston to the rotational motion of the input/output shafts in reciprocating machinery.

The data associated with a `Crank_shaft` are the following:

— `the_type`.

The `the_type` specifies, as text, the type of the crank-shaft.

4.2.66 Crankcase

A `Crankcase` is a type of `Mechanical_component` (see 4.2.306) and specifies the concept for all the crankcases that need to be defined. A crankcase is a boxlike casing enclosing the crankshaft and connecting rods of reciprocating machinery such as diesel engines and reciprocating pumps.

4.2.67 Crankshaft_web

A `Crankshaft_web` is a type of `Mechanical_component` (see 4.2.306) and specifies the concept for all the crankshaft webs that need to be defined. A crankshaft web is the arm of a crank, usually a flat, rectangular section, connecting the crankshaft pin to the shaft or connecting two adjacent pins.

4.2.68 Crosshead_pin

A `Crosshead_pin` is a type of `Mechanical_component` (see 4.2.306) and specifies the concept for all the diesel engine's crosshead pins that need to be defined. A crosshead pin is a journal supported in the crosshead for the small end bearing of the connecting rod.

4.2.69 Cylinder

A Cylinder is a type of Mechanical_component (see 4.2.306) and specifies the concept for all the reciprocating machinery's cylinders that need to be defined. A cylinder is a cylindrical chamber in which the combustion energy of the fuel is converted to mechanical force (reciprocating engines) or the input mechanical energy is converted to increased fluid pressure (reciprocating pumps and compressors).

4.2.70 Cylinder_dynamic_data

A Cylinder_dynamic_data specifies the basic dynamic data describing the state of fluid and enclosing wall materials for a cylinder of a reciprocating machinery.

The data associated with a Cylinder_dynamic_data are the following:

- crank_angle;
- cylinder_pressure;
- cylinder_temperature.

4.2.70.1 crank_angle

The crank_angle specifies the crankshaft position in terms of crank angle. The crank angle directly influences the cylinder volume and other cylinder properties.

4.2.70.2 cylinder_pressure

The cylinder_pressure specifies the magnitude of the working fluid pressure inside the cylinder.

4.2.70.3 cylinder_temperature

The cylinder_temperature specifies the magnitude of the working fluid temperature inside the cylinder.

4.2.71 Cylinder_liner

A Cylinder_liner is a type of Mechanical_component (see 4.2.306) and specifies the concept for all the cylinder liners that need to be defined. A cylinder liner is a hollow cylindrical casting made of special material that is fixed to internal walls of a cylinder to provide resistance against friction.

4.2.72 Damper

A Damper is a type of Mechanical_equipment (see 4.2.310) and specifies the concept for all the dampers that need to be defined. A damper is a device used to lessen torsional or axial vibrations in a shaft line.

4.2.73 Data_logging_system

A Data_logging_system is a type of Mechanical_system (see 4.2.326) and specifies the concept for defining all the data logging systems that need to be defined. A data logging system is used to measure and record a set of data over time.

4.2.74 De_aerator

A De_aerator is a type of Process_equipment (see 4.2.373) and specifies the concept for all the de-aerators that need to be defined. A de-aerator is an equipment used in high-pressure steam boilers, and consists of a vessel in which the boiler feed water is heated at lower pressure in order to remove dissolved gases that might damage the boiler metal.

4.2.75 De_oiler

A De_oiler is a type of Process_equipment (see 4.2.373) and specifies the concept for defining all the de-oilers that need to be defined. A de-oiler is a device used to separate the mixed oil from water.

4.2.76 Definable_object

A Definable_object is the supertype for all the objects which need to be defined.

The data associated with a Definable_object are the following:

-definitions.

The definitions attribute references a set of zero to many Definitions (see 4.2.77) which relate to a Definable-item.

4.2.77 Definition

A Definition is the top level concept for all the entities that specify product's definitions (see 3.10.32). Within this part of ISO 10303, each Definition is either a Physical_definition (see 4.2.348), a Functional_characteristic (see 4.2.179), a Configuration_definition (see 4.2.38), an Engineering_analysis_definition (see 4.2.131), a Product_anomaly_definition (see 4.2.377), a Mechanical_product_general_characteristic (see 4.2.321), or a Product_structure_definition (see 4.2.391).

The data associated with a Definition are the following:

- defined_for;
- description;
- version_identifier.

4.2.77.1 defined_for

The defined_for specifies the objects which are characterised by the Definition. There may be more than one defined_for for a Definition.

4.2.77.2 description

The description specifies a textual description of the context of Definition. The description need not be specified for a particular Definition.

4.2.77.3 version_identifier

The version_identifier provides simple version control. The version_identifier need not be specified for a particular Definition.

4.2.78 Definition_relationship

A Definition_relationship defines a relationship between definitional entities that together are the subject of a revision control and also specifies extra information about their relationship.

The data associated with a Definition_relationship are the following:

- definition_one;
- definition_two;
- description.

4.2.78.1 definition_one

The definition_one specifies the first Definition (see 4.2.77) that forms a relationship with another definition.

4.2.78.2 definition_two

The definition_two specifies the second Definition (see 4.2.77) that forms a relationship with another definition.

4.2.78.3 description

The description specifies, as text, the important aspects of the relationship between definitional entities. The description need not be specified for a particular Definition_relationship.

4.2.79 Delivery

A Delivery specifies the quantity and timing of a delivery of a mechanical product.

The data associated with a Delivery are the following:

- date;
- quantity.

4.2.79.1 date

The date specifies the calendar date of the delivery. The date need not be specified for a particular Delivery.

4.2.79.2 quantity

The quantity specifies the delivered quantity in the form of a real number.

4.2.80 Delivery_definition

A Delivery_definition is a type of Procurement_definition (see 4.2.375) and specifies the data associated with a delivery of a mechanical product.

The data associated with a Delivery_definition are the following:

- certificates;

- defined_for;
- suppliers;
- quantity_delivered.

4.2.80.1 certificates

The certificates attribute specifies zero to many Document_reference (see 4.2.107) that describe approval details of the delivered parts. There may be more than one certificates for Delivery_definition.

4.2.80.2 defined_for

The defined_for specifies a set of one to many mechanical products for which delivery definition is specified.

4.2.80.3 suppliers

The suppliers specify zero to many Person_and_organization (see 4.2.347) that are responsible for supplying the delivered mechanical products. The suppliers need not be specified for a particular Delivery_definition.

4.2.80.4 quantity_delivered

The quantity_delivered specifies a Delivery (see 4.2.79) that defines quantity and timing of the delivery.

4.2.81 Density

A Density is a type of Measure_with_unit (see 4.2.305) where the physical quantity is the density of a material.

The data associated with a Density are the following:

- density_unit.

The density_unit attribute specifies all the units which can be used to specify density.

4.2.82 Design_anomaly

A Design_anomaly is a type of Product_anomaly (see 4.2.376) that specifies the data which are attributable to design-related anomaly (see 3.10.6) of a mechanical product.

The data associated with a Design_anomaly are the following:

- design_anomaly_type

The design_anomaly_type specifies a descriptor for the type of design anomaly in textual format.

4.2.83 Design_characteristic

A Design_characteristic is a type of Functional_characteristic (see 4.2.179) and specifies the high level concept for all the definitions (see 3.10.32) that are attributable to the functional design of a mechanical product. Within this part of ISO 10303 each Design_characteristic is either an

Equipment_design_characteristic (see 4.2.133) or a Mechanical_system_design _characteristic (see 4.2.327).

The data associated with a Design_characteristic are the following:

- defined_for;
- design_stage.

4.2.83.1 defined_for

The defined_for specifies a set of one to many mechanical products for which design characteristics are defined. There may be more than one defined_for for a Design_characteristic.

4.2.83.2 design_stage

The design_stage specifies, as text, the stage of the design of a mechanical product.

4.2.84 Design_task

A Design_task is a type of Task (see 4.2.511) and specifies the concept for representing data that are attributable to a design task. Within this part of ISO 10303, a design task is a type of engineering analysis (see 3.10.38).

The data associated with a Design_task are the following:

- type_of_task.

The type_of_task specifies the type of design task in a text format.

4.2.85 Diesel_electric_plant

A Diesel_electric_plant is a type of Electric_power_generation_system (see 4.2.118) and specifies the concept for defining all the electric power plants that use only diesel engine as prime mover.

4.2.86 Diesel_engine

A Diesel_engine is a type of Reciprocating_machinery (see 4.2.416) that specifies the concept for all the marine diesel engines which need to be defined. A diesel engine is an internal combustion engine operating on the compression ignition principle.

The data associated with a Diesel-engine are the following:

- diesel_engine_type.

4.2.86.1 diesel_engine_type

The diesel_engine_type specifies the type of diesel engine.

The value of the diesel_engine_type shall be one of the following:

- high_speed;
- low_speed;

— `medium_speed`.

4.2.86.1.1 high speed: the descriptor that specifies that the diesel engine rated speed is at the high range for this type of application.

4.2.86.1.2 low_speed: the descriptor that specifies that the diesel engine rated speed is at the low range for this type of application.

4.2.86.1.3 medium_speed: the descriptor that specifies that the diesel engine rated speed is at the medium range for this type of application.

4.2.87 Diesel_engine_composition

A `Diesel_engine_composition` is a type of `Product_composition` (see 4.2.379) and specifies the composition (see 3.10.19) of a diesel engine in terms of its constituent mechanical products.

The data associated with a `Diesel_engine_composition` are the following:

— `defined_for`.

The `defined_for` specifies a set of one to many diesel engines for which composition is defined.

4.2.88 Diesel_engine_connectivity

A `Diesel_engine_connectivity` is a type of `Product_connectivity` (see 4.2.382) and specifies the connectivity of a diesel engine in terms of its connections to the other mechanical products at its boundary.

The data associated with a `Diesel_engine_connectivity` are the following:

— `defined_for`.

The `defined_for` specifies a set of one to many diesel engines for which connectivity is defined.

4.2.89 Diesel_engine_context

A `Diesel_engine_context` is a type of `Product_context` (see 4.2.383) and specifies the context, such as ship context and project context, within which the diesel engine is used or considered.

The data associated with a `Diesel_engine_context` are the following:

— `defined_for`.

The `defined_for` specifies a set of one to many diesel engines for which context is defined.

4.2.90 Diesel_engine_cylinder_data

A `Diesel_engine_cylinder_data` specifies the basic dynamic data for the cylinder, such as gas pressure and temperature.

The data associated with a `Diesel_engine_cylinder_data` are the following:

— cylinder_dynamic_data.

The cylinder_dynamic_data specifies a set of zero to many Cylinder_dynamic_data (see 4.2.70), providing a way to describe transient parametric changes within the cylinder

4.2.91 Diesel_engine_design_characteristic

A Diesel_engine_design_characteristic is a type of Machinery_design_characteristic (see 4.2.273) that specifies the functional design characteristics of a diesel engine.

The data associated with a Diesel_engine_design_characteristic are the following:

- defined_for;
- design_performance_data;
- piston_speed.

4.2.91.1 defined_for

The designed_for specifies a set of one to many diesel engines for which design characteristics are defined. There may be more than one defined_for for a Diesel_engine_design_characteristic.

4.2.91.2 design_performance_data

The design_performance_data specifies a set of diesel engine operating conditions, if any, representing the diesel engine functional design characteristic. There may be more than one design_performance_data for a particular Diesel_engine_design_characteristic.

4.2.91.3 piston_speed

The piston_speed specifies the linear speed of piston of the diesel engine.

4.2.92 Diesel_engine_drawing

A Diesel_engine_drawing is a type of Mechanical_product_drawing (see 4.2.318) and specifies the concept for associating various types of drawings to a diesel engine.

The data associated with a Diesel_engine_drawing are the following:

- defined_for.

The defined_for specifies a set of one to many diesel engines for which drawing is defined.

4.2.93 Diesel_engine_fuel_injection_data

A Diesel_engine_fuel_injection_data specifies the basic dynamic data for the fuel injection, such as injection pressure and injector needle lift.

The data associated with a Diesel_engine_fuel_injection_data are the following:

- fuel_injection_dynamic_data.

The `fuel_injection_dynamic_data` specifies a set of zero to many `Fuel_injection_dynamic_data` (see 4.2.175), providing a way to describe transient parametric changes for the fuel injection process.

4.2.94 Diesel_engine_general_characteristic

A `Diesel_engine_general_characteristic` is a type of `Machinery_general_characteristic` (see 4.2.274) which specifies the general characteristics (see 3.10.49) of a diesel engine.

The data associated with a `Diesel_engine_general_characteristic` are the following:

- `charge_cooler_arrangement`;
- `cylinder_configuration`;
- `cylinder_cooling_method`;
- `defined_for`;
- `engine_cycle`;
- `firing_angle`;
- `firing_interval`;
- `firing_order`;
- `fuel_injection_type`;
- `fuel_oil_system_type`;
- `fuel_type`;
- `piston_guide_type`;
- `pressure_charging_system`;
- `reversibility`;
- `starting_system_method`;
- `turbocharger_type`;
- `vee_angle`.

4.2.94.1 charge_cooler_arrangement

The `charge_cooler_arrangement` specifies the installed arrangement of the charge air cooler.

4.2.94.2 cylinder_configuration

The `cylinder_configuration` specifies whether the engine cylinder configuration is of type in-line or Vee.

The value of `cylinder_configuration` shall be one of the following:

- `in-line`;
- `vee`.

4.2.94.2.1 in-line: the descriptor which specifies that engine cylinders are located in line.

4.2.94.2.2 vee: the descriptor which specifies that engine cylinders are in located in Vee shape.

4.2.94.3 cylinder_cooling_method

The `cylinder_cooling_method` specifies the cooling method for a cylinder.

The value of `cylinder_cooling_method` shall be one of the following:

- `air_cooled`;

- user_defined_cooling_method;
- water_cooled.

4.2.94.3.1 air_cooled: the descriptor which specifies that the cylinder is cooled by air.

4.2.94.3.2 user_defined_cooling_method: the descriptor, set by the user, which specifies the cylinder cooling method if different from the other options.

4.2.94.3.3 water_cooled: the descriptor which specifies that the cylinder is cooled by water.

4.2.94.4 defined_for

The defined_for specifies a set of one to many diesel engines for which the general characteristics data are defined. There may be more than one defined_for for a Diesel_engine_general_characteristic.

4.2.94.5 engine_cycle

The engine_cycle specifies the number of revolutions per engine cycle. The value of the engine_cycle shall be one of the following:

- four_stroke;
- two_stroke.

4.2.94.5.1 four_stroke: the descriptor which specifies that the engine is a four stroke type (two revolutions per engine cycle).

4.2.94.5.2 two_stroke: the descriptor which specifies that the engine is a two stroke type (one revolution per engine cycle).

4.2.94.6 firing_angle

The firing_angle specifies the engine crank angle at which cylinder ignition/injection takes place.

4.2.94.7 firing_interval

The firing_interval specifies the nominal interval (in degrees) between two consecutive ignitions.

4.2.94.8 firing_order

The firing_order specifies the order by which ignition takes place in different cylinders, within a single engine cycle. This is an ordered list of cylinder numbers.

4.2.94.9 fuel_injection_type

The fuel_injection_type specifies the type of fuel injection system.

The value of the fuel_injection_type shall be one of the following:

- common_rail;
- distributor_type;
- user_defined_fuel_injection_system_type.

4.2.94.9.1 common_rail: the descriptor which specifies that this type of fuel injection system relies on one pumping element (plunger) per injector.

4.2.94.9.2 distributor_type: the descriptor which specifies that this type of fuel injection system relies on a single pumping element (plunger) to supply fuel to various injectors.

4.2.94.9.3 user_defined_fuel_injection_system_type: the descriptor, set by the user, which specifies the type of fuel injection system if different from the other options.

4.2.94.10 fuel_oil_system_type

The fuel_oil_system_type specifies the type of fuel oil supply system in text format.

4.2.94.11 fuel_type

The fuel_type specifies the type of fuel for the diesel engine.

The value of the fuel_type shall be one of the following:

- boil_off_gas;
- diesel_fuel;
- heavy_fuel_oil;
- natural_gas;
- user_defined_fuel_type.

4.2.94.11.1 boil_off_gas: the descriptor that specifies that the gas is collected on-board ships. It is the leaked gas that has been recovered.

4.2.94.11.2 diesel_fuel: the descriptor that specifies that this type of fuel represents the lighter cuts of liquid fuels used for diesel engine.

4.2.94.11.3 heavy_fuel_oil: the descriptor which specifies that this type of fuel represents the heavier cuts of liquid fuel used for diesel engines.

4.2.94.11.4 natural_gas: the descriptor which specifies that the type of fuel is natural gas.

4.2.94.11.5 user_defined_fuel_type: the descriptor, set by the user, which specifies the type of fuel if different from the other options.

4.2.94.12 piston_guide_type

The piston_guide_type specifies the type of the piston guide in text format.

4.2.94.13 pressure_charging_system

The pressure_charging_system attribute specifies the type of diesel engine pressure charging system.

The value of pressure_charging_system shall be one of the following:

- naturally_aspirated;
- supercharged;
- turbocharged;
- user_defined_pressure_charging_system.

4.2.94.13.1 naturally_aspirated: the descriptor which specifies that the engine is a naturally aspirated one (not pressure charged).

4.2.94.13.2 supercharged: the descriptor which specifies that the engine is supercharged by air compressor using shaft power.

4.2.94.13.3 turbocharged: the descriptor which specifies that the engine is turbocharged.

4.2.94.13.4 user_defined_pressure_charging_system: the descriptor, set by the user, if the pressure charging system is different from the other options.

4.2.94.14 reversibility

The reversibility specifies, as text, the engine capability to be driven in the reverse direction.

4.2.94.15 starting_system_method

The starting_system_method specifies the method of starting the diesel engine.

The value of the starting_system_method shall be one of the following:

- compressed_air;
- electrical;
- hydraulic;
- user_defined_starting_system_method.

4.2.94.15.1 compressed_air: the descriptor which specifies that the engine is started using a compressed air pneumatic system.

4.2.94.15.2 electrical: the descriptor which specifies that the engine is started using an electrical drive system.

4.2.94.15.3 hydraulic: the descriptor which specifies that the engine is started using a hydraulic drive system.

4.2.94.15.4 user_defined_starting_system_method: the descriptor, set by the user, which specifies the starting system method if different from the other options.

4.2.94.16 turbocharger_type

The turbocharger_type specifies, as text, the type of turbocharger used.

4.2.94.17 vee_angle

The vee_angle specifies the angle for the two banks of cylinders in a Vee-configured engine.

4.2.95 Diesel_engine_identification

A Diesel_engine_identification is a type of Equipment_identification (see 4.2.135) and specifies the data for identification of the diesel engine.

The data associated with a Diesel_engine_identification are the following:

— defined_for.

The defined_for specifies a set of one to many diesel engines for which identification is defined.

4.2.96 Diesel_engine_mass_weight_inertia

A Diesel_engine_mass_weight_inertia is a type of Mass_weight_inertia (see 4.2.297) and specifies the mass, weight and inertia for the diesel engine.

The data associated with a Diesel_engine_mass_weight_inertia are the following:

— defined_for.

The defined_for specifies a set of one to many diesel engines for which mass, weight and inertia are defined.

4.2.97 Diesel_engine_operational_characteristic

A Diesel_engine_operational_characteristic is a type of Operational_characteristic (see 4.2.341) and specifies a high level concept for all the diesel engine-related operational data. Within this part of ISO 10303, each Diesel_engine_operational_characteristic is either a Diesel_engine_overall_operational_data (see 4.2.100) or a Diesel_engine_operational_performance_data (see 4.2.98).

The data associated with a Diesel_engine_operational_characteristic are the following:

— defined_for.

The defined_for specifies a set of one to many diesel engines for which operational characteristics are defined.

4.2.98 Diesel_engine_operational_performance_data

A Diesel_engine_operational_performance_data is a type of Diesel_engine_operational_characteristic (see 4.2.97) and specifies the functional performance data for diesel engine operation.

The data associated with a Diesel_engine_operational_performance_data are the following:

— operational_performance_data.

The operational_performance_data specifies a set of Diesel_engine_performance_data (see 4.2.101), representing the diesel engine functional data at a number of operating conditions. There may be more than one operational_performance_data for a Diesel_engine_operational_performance_data.

4.2.99 Diesel_engine_overall_dimension

A Diesel_engine_overall_dimension is a type of Overall_dimension (see 4.2.345) and specifies the dimensional data for a diesel engine.

The data associated with a diesel_engine_overall_dimension are the following:

— compression_ratio;

- cylinder_bore;
- defined_for;
- piston_stroke.

4.2.99.1 compression_ratio

The compression_ratio specifies the cylinder compression ratio for the diesel engine.

4.2.99.2 cylinder_bore

The cylinder_bore specifies the cylinder bore diameter for the diesel engine.

4.2.99.3 defined_for

The defined_for specifies a set of one to many diesel engines for which the overall dimensions are defined.

4.2.99.4 piston_stroke

The piston_stroke specifies the length that piston travels at each stroke for the diesel engine.

4.2.100 Diesel_engine_overall_operational_data

A Diesel_engine_overall_operational_data is a type of Machinery_overall_operational_data (see 4.2.275) and Diesel_engine_operational_characteristic (see 4.2.97), and specifies the overall operational data including energy consumption and operating hours for a diesel engine.

4.2.101 Diesel_engine_performance_data

A Diesel_engine_performance_data is a type of Machinery_performance_data (see 4.2.276) and specifies the functional performance parameters for a diesel engine.

The data associated with a Diesel_engine_performance_data are the following:

- brake_mean_effective_pressure;
- brake_specific_fuel_consumption;
- cooling_water_data;
- cylinder_data;
- exhaust_emissions;
- exhaust_system_data;
- fuel-injection_data;
- indicated_mean_effective_pressure;
- intake_system_data;
- injection_timing;
- lube_oil_data;
- maximum_cylinder_pressure.

4.2.101.1 brake_mean_effective_pressure

The brake_mean_effective_pressure specifies the brake mean effective pressure for the diesel engine.

4.2.101.2 brake_specific_fuel_consumption

The brake_specific_fuel_consumption specifies the brake specific fuel consumption of a diesel engine.

4.2.101.3 cooling_water_data

The cooling_water_data specifies a set of fluid flow data, if any, that define the cooling water conditions at various positions in the diesel engine. There may be more than one cooling_water_data for a Diesel_engine_performance_data.

4.2.101.4 cylinder_data

The cylinder_data specifies the basic dynamic data for the cylinder, such as pressure, temperature and crank angle, through reference to Diesel_engine_cylinder_data (see 4.2.90) application object. The cylinder_data need not be specified for a particular Diesel_engine_performance_data.

4.2.101.5 exhaust_emissions

The exhaust_emissions specifies a set of exhaust emissions data, if any, that define the composition of gases at the exhaust system of diesel engine. There may be more than one exhaust_emissions for a Diesel_engine_performance_data.

4.2.101.6 exhaust_system_data

The exhaust_system_data specifies a set of fluid flow data, if any, that define the exhaust conditions at various positions in the exhaust system of the diesel engine. There may be more than one exhaust_system_data for a Diesel_engine_performance_data.

4.2.101.7 fuel_injection_data

The fuel_injection_data specifies the basic dynamic data for the engine fuel injection, such as crank angle, injection pressure and needle lift, through reference to Diesel_engine_fuel_injection_data (see 4.2.93) application object. The fuel_injection_data need not be specified for a particular Diesel_engine_performance_data.

4.2.101.8 indicated_mean_effective_pressure

The indicated_mean_effective_pressure specifies the indicated mean effective pressure of a diesel engine.

4.2.101.9 intake_system_data

The intake_system_data specifies a set of fluid flow data, if any, that define the conditions of the fluid at the diesel engine intake. There may be more than one intake_system_data for a Diesel_engine_performance_data.

4.2.101.10 injection_timing

The injection_timing specifies the crank angle when injection occurs, usually relative to the firing top dead centre in the piston movement cycle.

4.2.101.11 lube_oil_data

The lube_oil_data specifies a set of fluid flow data, if any, that define the lubrication oil conditions at various positions in the diesel engine. There may be more than one lube_oil_data for a Diesel_engine_performance_data.

4.2.101.12 maximum_cylinder_pressure

The maximum_cylinder_pressure specifies the maximum firing pressure for the cylinder.

4.2.102 Diesel_engine_placement

A Diesel_engine_placement is a type of Product_placement (see 4.2.388) and specifies the position of the diesel engine on the ship in terms of ship compartment and co-ordinate system.

The data associated with a Diesel_engine_placement are the following:

— defined_for.

The defined_for specifies a set of one to many diesel engines for which placement is defined.

4.2.103 Diesel_engine_status

A Diesel_engine_status is a type of Product_status (see 4.2.390) and specifies the status of a diesel engine in terms of its life-cycle phase.

The data associated with a Diesel_engine_status are the following:

— defined_for.

The defined_for specifies a set of one to many diesel engines for which status is defined.

4.2.104 Dilatation

A Dilatation is a type of Measure_with_unit (see 4.2.305) where the physical quantity is an increase in volume per unit volume of a continuous substance due to deformation.

The data associated with a Dilatation are the following:

— dilatation_unit.

The dilatation_unit specifies all the units that can be used to specify dilatation.

4.2.105 Direction

A Direction specifies a general direction vector in two or three dimensional space. It is used as defined in ISO 10303-42.

4.2.106 Document

A Document specifies global identification information for a document. Within this part of ISO 10303 each Document is either a Document_reference (see 4.2.107), an External_drawing (see 4.2.142) or an External_shape_representation (see 4.2.148).

The data associated with a Document are the following:

- approval_details;
- author;
- document_description;
- document_identifier;
- document_type;
- internal_locations;
- title;
- version_identifier.

4.2.106.1 approval_details

The approval_details specifies the approval status of a document, such as approved or rejected. There may be more than one approval_details for each Document.

4.2.106.2 author

The author attribute specifies full details of the authors of the document. There may be more than one author for a Document.

4.2.106.3 document_description

The document_description specifies, as text, significant information about the document.

4.2.106.4 document_identifier

The document_identifier specifies, as text, a set of characters used to uniquely identify the document locally.

4.2.106.5 document_type

The document_type specifies the type of each document.

The value for document_type shall be one of the following:

- book;
- drawing;
- report;
- user_defined.

4.2.106.5.1 book: the descriptor that identifies the document as a book.

4.2.106.5.2 drawing: the descriptor that identifies the document as a technical drawing.

4.2.106.5.3 report: the descriptor that identifies the document as a report.

4.2.106.5.4 user_defined: the descriptor, set by the user, that specifies the type of document if different from all other options.

4.2.106.6 internal_locations

The `internal_location` specifies, as text, additional information about the location of the document within the company or organisation. An `internal_location` need not be specified for a particular Document.

4.2.106.7 title

The title specifies, as text, the common title used to identify the content of the document.

4.2.106.8 version_identifier

The `version_identifier` specifies, as text, the version number of the document.

4.2.107 Document_reference

A `Document_reference` is a type of `External_reference` (see 4.2.145) and a type of `Document` (see 4.2.106) and specifies the qualification of a Document in terms of its source and location.

4.2.108 Duct

A `Duct` is a type of `Piping_component` (see 4.2.351) and specifies the concept for all the ducts that need to be defined.

The data associated with a `Duct` are the following:

— `the_type`.

The `the_type` specifies, as text, the type of the duct.

4.2.109 Ejector

An `Ejector` is a type of `Process_equipment` (see 4.2.373) and specifies the concept for defining all the ejectors that need to be defined. An ejector is an equipment that withdraws fluid material from an area by a steam or air jet. In power plants, ejectors are used to withdraw air from steam condenser using a steam jet.

4.2.110 Electric_generator

An `Electric_generator` is a type of `Electrical_machinery` (see 4.2.124) and specifies the concept for all the electric generators that need to be defined.

The data associated with an `Electric_generator` are the following:

— `electric_generator_type`.

4.2.110.1 electric_generator_type

The `electric_generator_type` specifies the type of the electric generator.

The value of `electric_generator_type` shall be one of the following:

- AC;
- DC.

4.2.110.1.1 AC: the descriptor that specifies that the electric generator produces alternate current.

4.2.110.1.2 DC: the descriptor that specifies that the electric generator produces direct current.

4.2.111 Electric_generator_design_characteristic

An `Electric_generator_design_characteristic` is a type of `Machinery_design_characteristic` (see 4.2.273) and specifies the functional design data for a electric generator.

The data associated with a `Electric_generator_design_characteristic` are the following:

- `defined_for`;

The `defined_for` specifies a set of one to many electric generators for which design characteristics are defined.

4.2.112 Electric_generator_general_characteristic

An `Electric_generator_general_characteristic` is a type of `Machinery_general_characteristic` (see 4.2.274) and specifies the electric generator's overall specifications and characteristics.

The data associated with a `Electric_generator_general_characteristic` are the following:

- `defined_for`.

The `defined_for` specifies a set of one to many electric generators for which general characteristics are defined.

4.2.113 Electric_generator_operational_characteristic

An `Electric_generator_operational_characteristic` is a type of `Operational_characteristic` (see 4.2.341) and specifies a high level concept for all the electric generator-related operational data.

The data associated with a `Electric_generator_operational_characteristic` are the following:

- `defined_for`.

The `defined_for` specifies a set of one to many electric generators for which operational characteristics are defined.

4.2.114 Electric_motor

An `Electric_motor` is a type of `Electrical_machinery` (see 4.2.124) and specifies the concept for all the electric motors that need to be defined.

The data associated with an `Electric_motor` are the following:

— electric_motor_type.

4.2.114.1 electric_motor_type

The electric_motor_type specifies the type of the electric motor.

The value of electric_motor_type shall be one of the following:

- AC;
- DC.

4.2.114.1.1 AC: the descriptor that specifies that the electric motor uses alternate current.

4.2.114.1.2 DC: the descriptor that specifies that the electric motor uses direct current.

4.2.115 Electric_motor_design_characteristic

An Electric_motor_design_characteristic is a type of Machinery_design_characteristic (see 4.2.273) and specifies the functional design data for an electric motor.

The data associated with an Electric_motor_design_characteristic are the following:

- defined_for.

The defined_for specifies a set of one to many electric motors for which design characteristics are defined.

4.2.116 Electric_motor_general_characteristic

An Electric_motor_general_characteristic is a type of Machinery_general_characteristic (see 4.2.274) and specifies the electric motor's overall specifications and characteristics.

The data associated with a Electric_motor_general_characteristic are the following:

- defined_for.

The defined_for specifies a set of one to many electric motors for which general characteristics are defined.

4.2.117 Electric_motor_operational_characteristic

An Electric_motor_operational_characteristic is a type of Operational_characteristic (see 4.2.341) and specifies a high level concept for all the electric motor-related operational data.

The data associated with an Electric_motor_operational_characteristic are the following:

- defined_for.

The defined_for specifies a set of one to many electric motors for which operational characteristics are defined.

4.2.118 Electric_power_generation_system

An Electric_power_generation_system is a type of Mechanical_system (see 4.2.326) and specifies the concept for specifying all the electric power generation systems that need to be defined. Within this part of ISO 10303, each Electric_power_generation_system is either a Diesel_electric_plant (see 4.2.85), a Gas_turbine_plant (see 4.2.200), a Combined_cycle_plant (see 4.2.34), a Steam_power_plant (see 4.2.495), or a Shaft_generator_system (see 4.2.460).

4.2.119 Electrical_connection_general_characteristic

An Electrical_connection_general_characteristic is a type of Product_connection_general_characteristic (see 4.2.381) and specifies the electric connection's overall specifications and characteristics.

The data associated with an Electrical_connection_general_characteristic are the following:

- defined_for;
- electric_flow_data.

4.2.119.1 defined_for

The defined_for specifies a set of one to many electrical connections for which general characteristics are defined.

4.2.119.2 electric_flow_data

The electric_flow_data specifies the details of the electrical requirements, such as electric voltage and current, of the electrical connection.

4.2.120 Electrical_connection

An Electrical_connection is a type of Mechanical_product_connection (see 4.2.317) that specifies the connection between a mechanical component and an electrical component or between two electrical components.

The data associated with an Electrical_connection are the following:

- connection_type.

4.2.120.1 connection_type

The connection_type specifies the type of electrical connection.

The value of the connection_type shall be one of the following:

- socketed;
- user_defined_connection_type;
- welded.

4.2.120.1.1 socketed: the descriptor that specifies that the electrical connection is made of two ends connected using sockets.

4.2.120.1.2 user_defined_connection_type: the descriptor, set by the user, which specifies the type of electric connection if different from the other options.

4.2.120.1.3 welded: the descriptor that specifies that the electrical connection is made of two ends that are welded together.

4.2.121 Electrical_connector

An `Electrical_connector` is a type of `Connector_component` (see 4.2.41) and specifies the concept for defining all the connectors that are classified as electrical connectors. Within this part of ISO 10303, each `Electrical_connector` is either a `Cable_end` (see 4.2.25), a `Plug` (see 4.2.364), a `Socket` (see 4.2.481), or a `Welded_end` (see 4.2.554).

4.2.122 Electrical_current

An `Electrical_current` is a type of `Measure_with_unit` (see 4.2.305) where the physical quantity is the electrical current.

The data associated with an `Electrical_current` are the following:

- `electrical_current_unit`.

The `electrical_current_unit` specifies all the engineering units which can be used for electrical current.

4.2.123 Electrical_equipment

An `Electrical_equipment` is a type of `Mechanical_product_equipment` (see 4.2.319) and specifies the concept for defining all the electrical equipment (see 3.10.36) that need to be defined. Within this part of ISO 10303, each `Electrical_equipment` is either a `Switch_board` (see 4.2.508), a `Transformer` (see 4.2.541), or a `Motor_starter` (see 4.2.333).

4.2.124 Electrical_machinery

An `Electrical_machinery` is a type of `Machinery` (see 4.2.271) and specifies the concept for all the electrical machinery that need to be defined. Within this part of ISO 10303, each `Electrical_machinery` is either an `Electric_motor` (see 4.2.114) or an `Electric_generator` (see 4.2.110).

4.2.125 Electrical_requirement

An `Electrical_requirement` is a type of `External_resources_requirement` (see 4.2.147) and specifies the level and details of electricity needed for the operation of a mechanical product.

The data associated with an `Electrical_requirement` are the following:

- `current`;
- `frequency`;
- `phase`;
- `power`;
- `voltage`.

4.2.125.1 current

The current specifies the magnitude of the electrical current.

4.2.125.2 frequency

The frequency specifies the frequency of the electrical system.

4.2.125.3 phase

The phase specifies, as text, the phase of the electrical system.

4.2.125.4 power

The power specifies the electrical power required by the equipment.

4.2.125.5 voltage

The voltage specifies the voltage of the electrical system.

4.2.126 Electrical_system

An `Electrical_system` is a type of `Mechanical_system` (see 4.2.326) that specifies the high level concept for all the ship's electrical systems which need to be defined.

The data associated with an `Electrical_system` are the following:

— `type_of`

The `type_of` specifies, as text, the type of electrical system.

4.2.127 Electrical_transmission_system

An `Electrical_transmission_system` is a type of `Mechanical_system` (see 4.2.326) and specifies the concept for defining all the electrical transmission systems that need to be defined. The `Electrical_transmission_system` application object is used within this part of ISO 10303 to provide a black box representation of all ship machinery electrical transmission systems with limited internal details of such systems.

4.2.128 Element_content

An `Element_content` specifies the significant compositional information for a material.

The data associated with an `Element_content` are the following:

- `element_content_percent`;
- `element_name`.

4.2.128.1 element_content_percent

The `element_content_percent` attribute specifies the percentage of each compositional element.

4.2.128.2 element_name

The element_name attribute specifies, as text, the name of each compositional element.

4.2.129 Energy

An Energy is a type of Measure_with_unit (see 4.2.305) where the physical quantity is the energy.

The data associated with an Energy are the following:

— energy_unit.

The energy_unit specifies all the engineering units which can be used for energy.

4.2.130 Energy_per_mass

An Energy_per_mass is a type of Measure_with_unit (see 4.2.305) when the physical quantity is the specific energy (energy per mass) of a material.

The data associated with an Energy_per_mass are the following:

— energy_per_mass_unit.

The energy_per_mass_unit attribute specifies all the units which can be used to specify density.

4.2.131 Engineering_analysis_definition

An Engineering_analysis_definition is a type of Definition (see 4.2.77) that specifies the high level concept for all the definitions (see 3.10.32) which results from an engineering analysis (see 3.10.38). Within this part of ISO 10303 each Engineering_analysis_definition is either a Crane_load_characteristic (see 4.2.58) or a RAM_characteristic (see 4.2.413).

4.2.132 Equipment_casing

An Equipment_casing specifies the concept for all the equipment casings that need to be defined. An equipment casing is a protective covering that encloses equipment, separating its internal components from outside environment. A casing must be strong enough to support normal working loads, maintain alignment of the equipment and if necessary be water, oil or air tight.

4.2.133 Equipment_design_characteristic

An Equipment_design_characteristic is a type of Design_characteristic (see 4.2.83) and specifies the high level concept for representation of all the design functional data that are attributable to all types of equipment.

The data associated with a Equipment_design_characteristic are the following:

— defined_for.

The defined_for specifies a set of one to many equipment for which design characteristics are defined.

4.2.134 Equipment_general_characteristic

An Equipment_general_characteristic is a type of Mechanical_product_general_characteristic (see 4.2.321) that specifies the high level concept for all the general characteristics data which need to be attributed to all the equipment. Within this part of ISO 10303 each Equipment_general_characteristic is either a Crane_general_characteristic (see 4.2.56), a Generic_equipment_general_characteristic (see 4.2.221), a Heat_exchanger_general_characteristic (see 4.2.236), a Machinery_general_characteristic (see 4.2.274), a Pump_general_characteristic (see 4.2.401), a Screw_propeller_general_characteristic (see 4.2.436) or a Shaft_general_characteristic (see 4.2.459).

The data associated with an equipment_general_characteristic are the following:

- date_of_manufacture;
- date_placed_in_service;
- defined_for;
- type_of_duty.

4.2.134.1 date_of_manufacture

The date_of_manufacture attribute specifies the date when the equipment was manufactured.

4.2.134.2 date_placed_in_service

The date_placed_in_service attribute specifies the date when the equipment was initially placed in service and operation.

4.2.134.3 defined_for

The defined_for specifies a set of one to many mechanical product equipment for which general characteristics are defined.

4.2.134.4 type_of_duty

The type_of_duty specifies, as text, the main features of equipment duty cycle. The type_of_duty need not be specified for a particular Equipment_general_characteristic.

4.2.135 Equipment_identification

An Equipment_identification is a type of Product_identification (see 4.2.385) and specifies the data that are needed for identification of the equipment. Within this part of ISO 10303 each Equipment_identification is either a Crane_identification (see 4.2.57), a Diesel_engine_identification (see 4.2.95), a Gas_turbine_engine_identification (see 4.2.191), a Gear_box_identification (see 4.2.208), a Generic_equipment_identification (see 4.2.222), a Heat_exchanger_identification (see 4.2.237), a Pump_identification (see 4.2.402) or a Screw_propeller_identification (see 4.2.437).

The data associated with a Equipment_identification are the following:

- acquisition_code;
- category_code;
- defined_for;
- equipment_change_history;

- identifiers;
- licence_details;
- model_and_nameplate_data;
- place_of_manufacture;
- tag_number.

4.2.135.1 acquisition_code

The acquisition_code specifies the equipment acquisition code (see 3.10.1). The acquisition_code need not be specified for a particular Equipment_identification.

4.2.135.2 category_code

The category_code specifies the code number of the equipment based on class of equipment. The category_code need not be specified for a particular Equipment_identification.

4.2.135.3 defined_for

The defined_for specifies a set of one to many equipment for which identification is defined.

4.2.135.4 equipment_change_history

The equipment_change_history specifies, as text, a description of major changes to equipment that are important for equipment identification. An equipment_change_history need not be specified for a particular Equipment_identification.

4.2.135.5 identifiers

The identifiers attribute specifies a set of the general identifiers, if any, as specified by various organisations. There may be more than one identifiers for an Equipment_identification.

4.2.135.6 licence_details

The licence_details specifies details of equipment manufacturing licence. The licence_details need not be specified for a particular Equipment_identification.

4.2.135.7 model_and_nameplate_data

The model_and_nameplate_data specifies the equipment identification information as used on the market. The model_and_nameplate_data need not be specified for a particular Equipment_identification.

4.2.135.8 place_of_manufacture

The place_of_manufacture specifies the place at which the equipment is manufactured.

4.2.135.9 tag_number

The tag_number specifies the mechanical product's tag number in the form of a label. The tag_number need not be specified for a particular Product_identification.

4.2.136 Equipment_location_condition

An Equipment_location_condition is a type of Mechanical_product_property (see 4.2.322) and specifies the main features of the equipment environment as applied to its installed location.

The data associated with an Equipment_location_condition are the following:

- heating_conditions;
- outdoor_indoor.

4.2.136.1 heating_conditions

The heating_conditions specify the air conditioning aspects of the environment in which equipment is located.

The value of the heating_conditions shall be one of the following:

- air_conditioned;
- heated;
- unheated;
- user_defined.

4.2.136.1.1 air_conditioned: the descriptor that specifies the equipment environment is, or should be, regulated by an air conditioner.

4.2.136.1.2 heated: the descriptor that specifies the equipment environment is, or should be, regulated by heating.

4.2.136.1.3 unheated: the descriptor that specifies the equipment environment does not need to be regulated by heating.

4.2.136.1.4 user_defined: the descriptor, set by the user, that specifies the heating conditions of the equipment if different from the other options.

4.2.136.2 outdoor_indoor

The outdoor_indoor specifies whether the equipment is located inside or outside, exposed to the natural environmental conditions.

The value of the outdoor_indoor shall be one of the following:

- indoor;
- outdoor.

4.2.136.2.1 indoor: the descriptor that specifies the equipment is located indoors.

4.2.136.2.2 outdoor: the descriptor that specifies the equipment is located outdoors.

4.2.137 Equipment_operation_status

An Equipment_operation_status is a type of Mechanical_product_property (see 4.2.322) and specifies the concept for defining equipment operational status in terms of fulfilling the function that it is designed to satisfy.

The data associated with an `Equipment_operation_status` are the following:

- `operation_status`.

4.2.137.1 `operation_status`

The `operation_status` specifies the operation status of the equipment in terms of the level by which it performs the required function.

The value of the `operation_status` shall be one of the following:

- `fully_operational`;
- `non_operational`;
- `partially_operational`;
- `user_defined_operation_status`.

4.2.137.1.1 `fully_operational`: the descriptor that specifies the equipment is in fully operational condition and can satisfy the required function.

4.2.137.1.2 `non_operational`: the descriptor that specifies the equipment is not in operational condition.

4.2.137.1.3 `partially_operational`: the descriptor that specifies the equipment is in partially operational condition and can satisfy only part of the required function.

4.2.137.1.4 `user_defined_operation_status`: the descriptor, set by the user, that specifies the equipment operation status if different from the other options.

4.2.138 `Exhaust_emission`

An `Exhaust_emission` is a type of `Mechanical_product_property` (see 4.2.322) that specifies the exhaust emissions data for a combustion system.

The data associated with an `Exhaust_emission` are the following:

- `emissions_units`;
- `nitrogen_oxides`;
- `particulates`;
- `smoke`;
- `sulphur_oxides`;
- `unburnt_hydrocarbon`.

4.2.138.1 `emissions_units`

The `emissions_units` attribute specifies, as text, the engineering units of exhaust emissions.

4.2.138.2 `nitrogen_oxides`

The `nitrogen_oxides` attribute specifies the level of exhaust nitrogen oxides.

4.2.138.3 particulates

The particulates attribute specifies the level of exhaust particulates.

4.2.138.4 smoke

The smoke attribute specifies the level of exhaust smoke.

4.2.138.5 sulphur_oxides

The sulphur_oxides attribute specifies the level of exhaust sulphur oxides.

4.2.138.6 unburnt_hydrocarbon

The unburnt_hydrocarbon attribute specifies the level of exhaust unburnt hydrocarbon.

4.2.139 Exhaust_gas_treatment_system

An Exhaust_gas_treatment_system is a type of Mechanical_system (see 4.2.326) and specifies the concept for defining all the exhaust gas treatment systems that need to be defined. The exhaust gas treatment systems are used to capture or reduce the undesirable exhaust emissions in the exhaust gas.

4.2.140 Exhaust_manifold

An Exhaust_manifold is a type of Mechanical_component (see 4.2.306) and specifies the concept for all the exhaust manifolds that need to be defined. An exhaust manifold is a pipe or chamber that has multiple openings to allow passage of exhaust gases from the exhaust valves of reciprocating engines to the atmosphere or to the exhaust gas driven turbines or turbochargers.

4.2.141 Expansion_joint

An Expansion_joint is a type of Piping_component (see 4.2.351) and specifies the concept for all the piping system expansion joints that need to be defined.

The data associated with a Expansion_joint are the following:

- the_type.

The the_type specifies, as text, the type of the expansion joint.

4.2.142 External_drawing

An External_drawing is a type of Document (see 4.2.106) and specifies information for identification of CAD drawings and their approval details.

The data associated with an External-drawing are the following:

- CAD_system_details;
- drawing_type.

4.2.142.1 CAD_system_details

The CAD_system_details specifies the name and version number of the CAD system used to generate the drawing.

4.2.142.2 drawing_type

The drawing_type attribute specifies the type of the drawing.

The value of drawing_type shall be one of the following:

- detailed_arrangement;
- exploded_view;
- general_arrangement;
- schematic;
- sectional_view;
- user_defined_drawing_type.

4.2.142.2.1 detailed_arrangement: the descriptor that specifies that the drawing is a detailed arrangement.

4.2.142.2.2 exploded_view: the descriptor that specifies that the drawing is an exploded view of a mechanical product.

4.2.142.2.3 general_arrangement: the descriptor that specifies that the drawing is of type general arrangement.

4.2.142.2.4 schematic: the descriptor that specifies that the drawing is of type schematic.

4.2.142.2.5 sectional_view: the descriptor which specifies that the drawing is of type sectional view.

4.2.142.2.6 user_defined_drawing_type: the descriptor, set by the user, which specifies the type of drawing if different from the other options.

4.2.143 External_instance_reference

An External_instance_reference is a type of External_reference (see 4.2.145) that specifies the concept for referencing an external instance of application objects in an exchange file.

The data associated with an External_instance_reference are the following:

- entity_name;
- global_unique_identifier;
- schema_name.

4.2.143.1 entity_name

The entity_name specifies, as label, the name of the externally referenced entity.

4.2.143.2 global_unique_identifier

The global_unique_identifier specifies a unique identifier for externally referenced entity.

4.2.143.3 schema_name

The schema_name specifies, as label, the name of the schema within which the entity is located.

4.2.144 External_mechanical_product_definition

An External_mechanical_product_definition is a type of External_instance_reference (see 4.2.143) that specifies the concept for referencing an externally defined instance of all the entities defined in this part of ISO 10303.

4.2.145 External_reference

An External_reference specifies the high level concept for referencing an information source, external to this part of ISO 10303. Within this part of ISO 10303 each External_reference is either a Document_reference (see 4.2.107), an External_instance_reference (see 4.2.143) or an External_reference_inside_source (see 4.2.146).

The data associated with an External_reference are the following:

- description;
- location;
- source_type.

4.2.145.1 description

The description specifies a description of the external source in text format.

4.2.145.2 location

The location specifies, as text, information required to identify the location of an external source.

4.2.145.3 source_type

The source_type specifies, as text, the type of the external source.

4.2.146 External_reference_inside_source

An External_reference_inside_source is a type of External_reference (see 4.2.145) with a pointer to a location inside the source of information. If the source is for example a book, the pointer could be a section label or a page number.

The data associated with an External_reference_inside_source are the following:

- line_number;
- page;
- paragraph;
- section.

4.2.146.1 line_number

The `line_number` specifies a line number within the source of information. The `line_number` need not be specified for a particular `External_reference_inside_source`.

4.2.146.2 page

The page specifies the page number within the source of information. The page need not be specified for a particular `External_reference_inside_source`.

4.2.146.3 paragraph

The paragraph specifies the paragraph identifier within the source of information. The paragraph need not be specified for a particular `External_reference_inside_source`.

4.2.146.4 section

The section specifies a section label within the source of information . The section need not be specified for a particular `External_reference_inside_source`.

4.2.147 External_resources_requirement

An `External_resources_requirement` is a type of `Mechanical_product_property` (see 4.2.322) and specifies the high level concept for representing all the resources and utilities required by a mechanical product.

The data associated with an `External_resources_requirement` are the following:

- `description`;
- `max_min_option`.

4.2.147.1 description

The `description` specifies, as text, details of the external resources requirement.

4.2.147.2 max_min_option

The `max_min_option` specifies, in keywords, the level of the requirements. The operating condition to which the requirements apply normally will be part of this specification.

The value of `max_min_option` shall be one of the following:

- `maximum`;
- `minimum`;
- `user_defined`.

4.2.147.2.1 maximum: the descriptor which specifies that the stated requirements correspond to a maximum level.

4.2.147.2.2 minimum: the descriptor which specifies that the stated requirements correspond to a minimum level.

4.2.147.2.3 user_defined: the descriptor, set by the user, that specifies the level of the requirements if different from the other options.

4.2.148 External_shape_representation

An External_shape_representation is a type of Document (see 4.2.106) and provides details of a document that represents a CAD generated shape representation of a mechanical product.

The data associated with an External_shape_representation are the following:

- CAD_system_details;
- shape_representation_type.

4.2.148.1 CAD_system_details

The CAD_system_details specifies the name and version number of the CAD system used to generate the shape of the product.

4.2.148.2 shape_representation_type

The shape_representation_type specifies the type of the product shape representation.

The value of shape_representation_type shall be one of the following:

- user_defined

4.2.148.2.1 user_defined: the descriptor, set by the user, that specifies the type of the shape representation.

4.2.149 Failure

A Failure is a type of Product_anomaly (see 4.2.376) that specifies the data that are attributable to a mechanical product failure (see 3.7).

The data associated with a Failure are the following:

- failure_mode.

4.2.149.1 failure_mode

The failure_mode specifies the failure mode (see 3.6) for a mechanical product failure.

The value of the failure_mode shall be one of the following:

- breakdown;
- failed_to_start;
- failed_to_stop;
- failure_to_change_position;
- failure_to_remain_in_position;
- leakage;
- shutdown;
- sustained_abnormal_condition_performance;
- unexpected_stop;
- unknown mode;
- user_defined_mode.

4.2.149.1.1 breakdown: the failure mode descriptor when failure is discovered in the form of a serious physical damage or problem including seizure, breakage, explosion and so on.

4.2.149.1.2 failed_to_start: the failure mode descriptor when failure is discovered in the form of equipment failing to start on demand.

4.2.149.1.3 failed_to_stop: the failure mode descriptor when failure is discovered in the form of equipment failing to stop on demand.

4.2.149.1.4 failure_to_change_position: the failure mode descriptor when failure is discovered in the form of not being able to change position on demand.

NOTE this failure mode primarily applies to control devices.

4.2.149.1.5 failure_to_remain_in_position: the failure mode descriptor when failure is discovered in the form of not being able to control the position of a device.

NOTE this failure mode primarily applies to control devices.

4.2.149.1.6 leakage: the failure mode descriptor when failure is discovered in the form of unexpected and unacceptable level of leakage.

4.2.149.1.7 shutdown: the failure mode descriptor when a perceived failure leads to an equipment shut down.

NOTE in case of shutdown due to a real failure, this descriptor should not be used and one of the other options in this list should be assigned.

4.2.149.1.8 sustained_abnormal_condition_performance: the failure mode descriptor when failure is discovered in the form of sustained abnormal conditions of unacceptable noise, vibration, overheating and so on or sustained deviation of equipment performance from its design conditions.

4.2.149.1.9 unexpected_stop: the failure mode descriptor when failure is discovered in the form of equipment stopping unexpectedly.

4.2.149.1.10 unknown_mode: the failure mode descriptor when the failure mode is unknown.

4.2.149.1.11 user_defined_mode: the failure mode descriptor, set by the user, when failure discovered in any other form than the stated options.

4.2.150 Failure_cause

A Failure_cause is a type of Anomaly_cause (see 4.2.8) that specifies the reasons behind the occurrence of a failure.

The data associated with a Failure_cause are the following:

- defined_for;
- failure_cause;
- failure_cause_details;
- failure_discovery_description.

4.2.150.1 defined_for

The `defined_for` specifies a set of one to many failures for which a cause is defined. There may be more than one `defined_for` for a `Failure_cause`.

4.2.150.2 `failure_cause`

The `failure_cause` specifies the cause of failure.

The value of the `failure_cause` shall be one of the following:

- `assembly_error`;
- `improper_design`;
- `improper_manufacturing`;
- `improper_material`;
- `installation_error`;
- `maintenance_error`;
- `management_error`;
- `manufacturing_error`;
- `off_design_service`;
- `operation_error`;
- `user_defined_cause`.

4.2.150.2.1 `assembly_error`: the failure cause descriptor when failure is caused due to assembly deficiencies.

4.2.150.2.2 `improper_design`: the failure cause descriptor when failure is caused due to design deficiencies.

4.2.150.2.3 `improper_manufacturing`: the failure cause descriptor when failure is caused due to manufacturing deficiencies.

4.2.150.2.4 `improper_material`: the failure cause descriptor when failure is caused due to deficiency in material properties.

4.2.150.2.5 `installation_error`: the failure cause descriptor when failure is caused due to installation deficiencies.

4.2.150.2.6 `maintenance_error`: the failure cause descriptor when failure is caused due to poor or wrong maintenance work.

4.2.150.2.7 `management_error`: the failure cause descriptor when failure is caused due to managerial or administrative errors.

4.2.150.2.8 `manufacturing_error`: the failure cause descriptor when failure is caused due to manufacturing deficiencies.

4.2.150.2.9 `off_design_error`: the failure cause descriptor when failure is caused due to operation under off-design conditions.

4.2.150.2.10 `operation_error`: the failure cause descriptor when failure is caused due to errors during normal operation.

4.2.150.2.11 `user_defined_cause`: the failure cause descriptor, set by the user, when failure is caused by anything other than the other options.

4.2.150.3 failure_cause_details

The failure_cause_details references a document that contains detailed description of the cause of failure.

4.2.150.4 failure_discovery_description

The failure_discovery_description specifies a textual description of the way the failure is discovered.

4.2.151 Failure_configuration_data

A Failure_configuration_data is a type of Anomaly_configuration_data (see 4.2.9) and specifies the concept for defining all the data relating to a failure.

The data associated with a Failure_configuration_data are the following:

- defined_for;
- failure_descriptor;
- failure_type.

4.2.151.1 defined_for

The defined_for specifies a set of one to many failures for which configuration data are defined.

4.2.151.2 failure_descriptor

The failure_descriptor specifies the main characteristic of a failure.

The value of failure_descriptor shall be one of the following:

- burning;
- burst;
- cavitation;
- clearance_alignment;
- contamination;
- corrosion;
- deformation;
- fatigue;
- leakage;
- looseness;
- short_circuit;
- sticking;
- user_defined_failure_descriptor;
- vibration;
- wear.

4.2.151.2.1 burning: the descriptor which specifies that the failure is caused by a local burning.

4.2.151.2.2 burst: the descriptor which specifies that the failure is caused by bursting.

4.2.151.2.3 cavitation: the descriptor which specifies that the failure is caused by flow cavitation.

4.2.151.2.4 clearance_alignment: the descriptor which specifies that the failure is caused by incorrect clearance alignment.

4.2.151.2.5 contamination: the descriptor which specifies that the failure is due to contamination.

4.2.151.2.6 corrosion: the descriptor which specifies that the failure is caused by corrosion.

4.2.151.2.7 deformation: the descriptor which specifies that the failure is caused by deformation of geometric shape.

4.2.151.2.8 fatigue: the descriptor which specifies that the failure is caused by fatigue.

4.2.151.2.9 leakage: the descriptor which specifies that the failure is caused by fluid leakage.

4.2.151.2.10 looseness: the descriptor which specifies that the failure is caused by looseness of components.

4.2.151.2.11 short_circuit: the descriptor which specifies that the failure is caused by electrical short circuiting.

4.2.151.2.12 sticking_together: the descriptor which specifies that the failure is caused by the moving components being stick together.

4.2.151.2.13 user_defined_failure_descriptor: the descriptor, set by the user, which specifies an overall description of the cause of failure if different from the other options.

4.2.151.2.14 vibration: the descriptor which specifies that the failure is caused by excessive vibration.

4.2.151.2.15 wear: the descriptor which specifies that the failure is caused by wear and tear.

4.2.151.3 failure_type

The failure_type specifies the basic type of a failure.

The value of failure_type shall be one of the following:

- electrical_failure;
- mechanical_failure;
- structural_failure;
- user_defined_failure_type.

4.2.151.3.1 electrical_failure: the descriptor that specifies the failure relates to an electrical anomaly.

4.2.151.3.2 mechanical_failure: the descriptor that specifies the failure relates to a mechanical anomaly.

4.2.151.3.3 structural_failure: the descriptor that specifies the failure relates to a structural anomaly.

4.2.151.3.4 user_defined_failure_type: the descriptor, set by the user, that specifies the type of anomaly according to engineering discipline, that has caused the failure, if different from the other options.

4.2.152 Failure_criticality

A Failure_criticality is a type of Anomaly_criticality (see 4.2.10) and specifies the concept for defining all the data relating to a failure criticality.

The data associated with a Failure_criticality are the following:

- criticality_details;
- defined_for;
- failure_criticality;
- failure_criticality_level.

4.2.152.1 criticality_details

The criticality_details specifies, as text, the details of the failure criticality. The criticality_details need not be specified for a particular Failure_criticality.

4.2.152.2 defined_for

The defined_for specifies a set of one to many failures for which criticality is defined.

4.2.152.3 failure_criticality

The failure_criticality describes the basic criticality of a failure.

The value of failure_criticality shall be one of the following:

- critical_failure;
- non_critical_failure.

4.2.152.3.1 critical_failure: the descriptor that specifies the failure as being critical (see 3.7).

4.2.152.3.2 non_critical_failure: the descriptor that specifies the failure as being non-critical (see 3.7).

4.2.152.4 failure_criticality_level

The failure_criticality_level describes level of criticality of a failure.

The value of failure_criticality_level shall be one of the following:

- catastrophic;
- major;
- minor;
- user_defined.

4.2.152.4.1 catastrophic: the descriptor that specifies the failure as being a catastrophic failure.

4.2.152.4.2 major: the descriptor that specifies the failure as being a major failure.

4.2.152.4.3 minor: the descriptor that specifies the failure as being a minor failure.

4.2.152.4.4 user_defined: the descriptor, set by the user, that specifies the level of failure criticality, if different from the other options.

4.2.153 Failure_effect

A Failure_effect is a type of Anomaly_effect (see 4.2.11) that specifies the data which define various effects of a failure on operational aspects of a product or a ship.

The data associated with a Failure_effect are the following:

- defined_for;
- failure_effect_description;
- failure_effect_on_product;
- failure_effect_on_ship.

4.2.153.1 defined_for

The defined_for for specifies a set of one to many failures for which the effect it is having on a product or a ship is defined. There may be more than one defined_for for a Failure_effect.

4.2.153.2 failure_effect_description

The failure_effect_description specifies a textual description of the effect of failure.

4.2.153.3 failure_effect_on_product

The failure_effect_on_product specifies the effect of the failure on product function.

The value of the failure_effect_on_product shall be one of the following:

- complete_failure;
- degraded_performance;
- incipient_failure;
- user_defined_failure_level.

4.2.153.3.1 complete_failure: the descriptor that specifies that the failure has caused a complete loss of product capability.

4.2.153.3.2 degraded_performance: the descriptor that specifies that the failure has some degrading effect on product operational capability such as its performance.

4.2.153.3.3 incipient_failure: the descriptor that specifies that the failure has just started to happen.

4.2.153.3.4 user_defined_failure_level: the descriptor, set by the user, that specifies the level of failure on a product if different from other options.

4.2.153.4 failure_effect_on_ship

The failure_effect_on_ship specifies the effect of failure on the ship.

The value of the failure_effect_on_ship shall be one of the following:

- complete_failure_of_capability;
- degraded_ship_capability;
- normal_ship_operation;

— `user_defined_effect_on_ship`.

4.2.153.4.1 complete_failure_of_capability: the descriptor that specifies that the failure has caused a complete loss of ship capability.

4.2.153.4.2 degraded_ship_capability: the descriptor that specifies that the failure has some degrading effect on ship capability such as performance, speed and mission.

4.2.153.4.3 normal_ship_operation: the descriptor that specifies that the failure has no significant effect on normal ship operation.

4.2.153.4.4 user_defined_effect_on_ship: the descriptor, set by the user, that specifies the effect of failure on ship if different from other options.

4.2.154 Failure_fault_relationship

A `Failure_fault_relationship` defines a relationship between a Failure (see 4.2.149) and a Fault (see 4.2.156) and also specifies extra information, if any, about this relationship.

The data associated with a `Failure_fault_relationship` are the following:

- `related_failure`;
- `related_fault`.

4.2.154.1 related_failure

The `related_failure` specifies a particular Failure (see 4.2.149) that is a part of the relationship with a particular fault.

4.2.154.2 related_fault

The `related_fault` specifies a particular Fault (see 4.2.156) that is a part of the relationship with a particular failure.

4.2.155 Failure_time_and_date

A `Failure_time_and_date` is a type of `Anomaly_time_and_date` (see 4.2.12) and specifies the important times and dates that are associated to a failure.

The data associated with a `Failure_time_and_date` are the following:

- `defined_for`;
- `time_between_failure`;
- `time_to_failure`.

4.2.155.1 defined_for

The `defined_for` specifies a set of one to many failures for which times and dates are defined.

4.2.155.2 time_between_failure

The `time_between_failure` specifies elapsed time between the occurrence of two consecutive failures according to IEC50 (191).

4.2.155.3 time_to_failure

The `time_to_failure` specifies elapsed time to the first occurrence of a failure according to IEC50 (191).

4.2.156 Fault

A `Fault` is a type of `Product_anomaly` (see 4.2.376) that specifies the data that are attributable to a mechanical product fault (see 3.7).

The data associated with a `Fault` are the following:

- `fault_category`.

The `fault_category` specifies, as text, a textual description of the fault categorisation.

4.2.157 Fault_cause

A `Fault_cause` is a type of `Anomaly_cause` (see 4.2.8) and specifies the concept for defining all the data relating to a fault cause.

The data associated with a `Fault_cause` are the following:

- `defined_for`;
- `fault_cause`
- `fault_cause_details`;
- `fault_discovery_description`.

4.2.157.1 defined_for

The `defined_for` specifies a set of one to many faults for which the cause data are defined.

4.2.157.2 fault_cause

The `fault_cause` specifies, as text, a description of the fault cause.

4.2.157.3 fault_cause_details

The `detailed_fault_cause` specifies a set of documents that contain detailed descriptions of the causes for the fault. There may be more than one `fault_cause_details` for a `Fault_cause`.

4.2.157.4 fault_discovery_description

The `fault_discovery_description` specifies, as text, the way the fault has been discovered. The `fault_discovery_description` need not be specified for a particular `Fault_cause`.

4.2.158 Fault_configuration_data

A `Fault_configuration_data` is a type of `Anomaly_configuration_data` (see 4.2.9) and specifies the concept for defining all the data relating to a fault.

The data associated with a `Fault_configuration_data` are the following:

- `defined_for`;
- `fault_class`;
- `fault_method_of_diagnosis`.

4.2.158.1 `defined_for`

The `defined_for` specifies a set of one to many faults for which configuration data are defined.

4.2.158.2 `fault_class`

The `fault_class` describes the main characteristic of a fault.

The value of `fault_class` shall be one of the following:

- `design_fault`;
- `mishandling_fault`;
- `misuse_fault`;
- `user_defined_fault_class`;
- `wear_out_fault`.

4.2.158.2.1 `design_fault`: the descriptor which specifies that the fault has occurred because of improper design.

4.2.158.2.2 `mishandling_faults`: the descriptor which specifies that the fault has occurred due to mishandling of the product.

4.2.158.2.3 `misuse_fault`: the descriptor which specifies that the fault has occurred due to use of the mechanical product beyond its design and operational limits.

4.2.158.2.4 `user_defined_fault_class`: the descriptor, set by the user, that specifies the class of fault if different from the other options.

4.2.158.2.5 `wear_out_fault`: the descriptor which specifies that the fault has occurred due to wear and tear.

4.2.158.3 `fault_method_of_diagnosis`

The `fault_method_of_diagnosis` describes the method used to diagnose a fault.

The value of `fault_method_of_diagnosis` shall be one of the following:

- `class_survey`;
- `condition_monitoring_continuous`;
- `condition_monitoring_periodic`;
- `corrective_maintenance`;
- `functional_testing`;
- `inspection`;
- `preventive_maintenance`;
- `user_defined_method_of_diagnosis`.

4.2.158.3.1 class_survey: the descriptor which specifies that the fault has been diagnosed as a result of a classification society survey.

4.2.158.3.2 condition_monitoring_continuous: the descriptor which specifies that the fault has been diagnosed using a continuous condition monitoring system.

4.2.158.3.3 condition_monitoring_periodic: the descriptor which specifies that the fault has been diagnosed as a result of a periodic condition monitoring.

4.2.158.3.4 corrective_maintenance: the descriptor which specifies that the fault has been diagnosed while performing a corrective maintenance task.

4.2.158.3.5 functional_testing: the descriptor which specifies that the fault has been diagnosed by functional testing of the equipment.

4.2.158.3.6 inspection: the descriptor which specifies that the fault has been diagnosed as a result of an inspection.

4.2.158.3.7 preventive_maintenance: the descriptor which specifies that the fault has been diagnosed as a result of preventive_maintenance.

4.2.158.3.8 user_defined_method_of_diagnosis: the descriptor, set by the user, that specifies the method of fault diagnosis if different from the other options.

4.2.159 Fault_criticality

A Fault_criticality is a type of Anomaly_criticality (see 4.2.10) that specifies the data defining the criticality of a fault on the basis of safety and fitness for a purpose.

The data associated with a Fault_criticality are the following:

- defined_for;
- fault_criticality;
- fault_severity_functional;
- fault_severity_safety.

4.2.159.1 defined_for

The defined_for specifies a set of one to many faults for which its criticality is defined.

4.2.159.2 fault_criticality

The fault_criticality specifies, as text, the importance of the fault on the operational aspects of a mechanical product.

4.2.159.3 fault_severity_functional

The fault_severity_functional attribute specifies a descriptor for the severity of the fault in relation to influencing the product's function.

The value of fault_severity_functional shall be one of the following:

- complete_fault;

- major_fault;
- minor_fault.

4.2.159.3.1 complete_fault: the descriptor that specifies that the fault is a complete fault, resulting in a complete loss of the product's function.

4.2.159.3.2 major_fault: the descriptor that specifies that the fault is a major fault, resulting in a significant loss of the product's function.

4.2.159.3.3 minor_fault: the descriptor that specifies that the fault is a minor fault, resulting in no significant loss of product's function.

4.2.159.4 fault_severity_safety

The fault_severity_safety attribute specifies a descriptor for the severity of the fault in relation to safety of life or major assets.

The value of fault_severity_safety shall be one of the following:

- critical_fault;
- non_critical_fault.

4.2.159.4.1 critical_fault: the descriptor that specifies that the fault is a critical fault.

4.2.159.4.2 non_critical_fault: the descriptor that specifies that the fault is a non-critical fault.

4.2.160 Fault_effect

A Fault_effect is a type of Anomaly_effect (see 4.2.11) and specifies the concept for defining all the data relating to the effects of a fault.

The data associated with a Fault_effect are the following:

- defined_for;
- fault_effect_description.

4.2.160.1 defined_for

The defined_for specifies a set of one to many faults for which the effects they are having on the equipment are defined.

4.2.160.2 fault_effect_description

The fault_effect_description specifies, as text, a detailed description of all the effects of the fault.

4.2.161 Fault_time_and_date

A Fault_time_and_date is a type of Anomaly_time_and_date (see 4.2.12) and defines the precise timing of the fault.

The data associated with a Fault_time_and_date are the following:

- defined_for.

The `defined_for` specifies a set of one to many faults for which time and date are defined.

4.2.162 Filter

A Filter is a type of `Process_equipment` (see 4.2.373) and specifies the concept for all the filters that need to be defined. A filter is a device or porous substance through which a gas or a liquid is passed in order to remove solids or impurities.

The data associated with a Filter are the following:

- `filter_type`.

4.2.162.1 filter_type

The `filter_type` specifies the type of the filter.

The value of `filter_type` shall be one of the following:

- `air_filter`;
- `fuel_filter`;
- `lub_oil_filter`;
- `user_defined_filter`.

4.2.162.1.1 air_filter: the descriptor that specifies that the filter is used to purify air.

4.2.162.1.2 fuel_filter: the descriptor that specifies that the filter is used to purify fuel.

4.2.162.1.3 lub_oil_filter: the descriptor that specifies that the filter is used to purify lubrication oil.

4.2.162.1.4 user_defined_filter: the descriptor, set by the user, that specifies the type of the filter if different from the other options.

4.2.163 Fitting

A Fitting is a type of `Piping_component` (see 4.2.351) and specifies the concept for all the fittings that need to be defined.

The data associated with a Fitting are the following:

- `the_type`.

The `the_type` specifies, as text, the type of the fitting.

4.2.164 Flexible_coupling

A `Flexible_coupling` is a type of `Shaft_coupling` (see 4.2.454) and specifies the concept for defining all the flexible couplings that need to be defined. A flexible coupling is a coupling containing a resilient members such as a metal spring or rubber disk. Flexible coupling is used to connect two shafts with certain amount of flexibility and allowance in their axial or radial alignment.

4.2.165 Flowrate_sensor

A Flowrate_sensor is a type of Sensor (see 4.2.448) and specifies the concept for defining all the sensors that are used for measuring flowrate. Both mass flowrate and volumetric flowrate sensors are represented by this application object.

4.2.166 Fluid_chemical_property

A Fluid_chemical_property is a type of Material_chemical_property (see 4.2.299) that specifies the high level concept for all the chemical properties that are attributable to a fluid.

The data associated with a Fluid_chemical_property are the following:

- ignition_temperature.

The ignition_temperature specifies the self ignition temperature of a fluid.

4.2.167 Fluid_coupling

A Fluid_coupling is a type of Shaft_coupling (see 4.2.454) and specifies the concept for defining all the fluid couplings that need to be defined. A fluid coupling is a device in which a fluid, such as oil, transmits torque from input shaft to output shaft. There is no mechanical link between the two shafts in this type of coupling.

4.2.168 Fluid_flow_data

A Fluid_flow_data is a type of Mechanical_product_property (see 4.2.322) that specifies the data such as fluid temperature, pressure and flowrate for any type of fluids that is used in relation to a mechanical product.

The data associated with a Fluid_flow_data are the following:

- flowrate;
- fluid_pressure;
- fluid_temperature;
- point_in_the_system.

4.2.168.1 flowrate

The flowrate attribute specifies the flowrate of the fluid.

4.2.168.2 fluid_pressure

The fluid_pressure attribute specifies the pressure of the fluid.

4.2.168.3 fluid_temperature

The fluid_temperature attribute specifies the temperature of the fluid.

4.2.168.4 point_in_the_system

The point_in_the_system specifies the location in the flow system, for which fluid flow data are specified.

4.2.169 Fluid_material

A Fluid_material is a type of Material (see 4.2.298) and specifies the concept for all the fluid materials and their properties that need to be defined. Within this part of ISO 10303, each Fluid_material is either a Gas_material (see 4.2.181) or a Liquid_material (see 4.2.265).

4.2.170 Fluid_material_requirement

A Fluid_material_requirement is a type of Material_requirement (see 4.2.304) and specifies the state and level of fluid material that is needed for the operation of a mechanical product.

The data associated with a Fluid_material_requirement are the following:

- flow_data.

The flow_data specifies the required fluid pressure, temperature and flowrate.

4.2.171 Fluid_physical_property

A Fluid_physical_property is a type of Material_physical_property (see 4.2.302) and specifies physical properties that are attributable to all types of fluids. Within this part of ISO 10303 each Fluid_physical_property is either a Gas_physical_property (see 4.2.183) or a Liquid_physical_property (see 4.2.267).

The data associated with a Fluid_physical_property are the following:

- reference_pressure;
- reference_temperature;
- viscosity.

4.2.171.1 reference_pressure

The reference_pressure specifies the reference pressure for all the pressure-dependent properties.

4.2.171.2 reference_temperature

The reference_temperature specifies the reference temperature for all the temperature-dependent properties.

4.2.171.3 viscosity

The viscosity attribute specifies the fluid kinematic viscosity.

4.2.172 Flywheel

A Flywheel is a type of Rotating_component (see 4.2.421) and specifies the concept for all the flywheels that need to be defined. A flywheel is a heavy wheel that rotates on a shaft so that its momentum imparts uniform rotational velocity to the shaft and attached machinery.

The data associated with a Flywheel are the following:

— the_type.

The the_type specifies, as text, the type of the flywheel.

4.2.173 Force

A Force is a type of Measure_with_unit (see 4.2.305) where the physical quantity is the force.

The data associated with a Force are the following:

— Force_units.

The Force_unit specifies all the engineering units which can be used for Force.

4.2.174 Frequency

A Frequency is a type of Measure_of_unit (see 4.2.305) where the physical quantity is the frequency.

The data associated with a Frequency are the following:

— frequency_units.

The frequency_unit specifies all the engineering units which can be used for frequency.

4.2.175 Fuel_injection_dynamic_data

A Fuel_injection_dynamic_data specifies the basic dynamic data describing the fuel injection process.

The data associated with a Fuel_injection_dynamic_data are the following:

- crank_angle;
- injection_pressure;
- needle_lift.

4.2.175.1 crank_angle

The crank_angle specifies the engine crank angle magnitude and unit.

4.2.175.2 injection_pressure

The injection_pressure specifies the fuel injection pressure magnitude and unit.

4.2.175.3 needle_lift

The needle_lift specifies the relative position of the injector needle.

4.2.176 Fuel_injection_system

A Fuel_injection_system is a type of Machinery_piping_system (see 4.2.277) and specifies the concept for all the fuel injection systems that need to be defined. A fuel injection system is used to supply fuel, in atomised form, to the combustion chamber of a prime mover such as diesel engine and gas turbine.

The data associated with a Fuel_injection_system are the following:

- system_type.

The system_type specifies, as text, the type of the fuel injection system.

4.2.177 Fuel_injector

A Fuel_injector is a type of Mechanical_component (see 4.2.306) and specifies the concept for all the fuel injectors that need to be defined. A fuel injector is a device that sprays fuel into the engine cylinders or combustion chambers. The fuel is supplied to the injector at high pressure normally by using a pump.

4.2.178 Fuel_supply_system

A Fuel_supply_system is a type of Machinery_piping_system (see 4.2.277) and specifies the concept for all the fuel supply systems that need to be defined. A fuel supply system is used to purify, store and deliver fuel to ship prime movers and auxiliary machinery.

The data associated with a Fuel_supply_system are the following:

- system_type.

The system_type specifies, as text, the type of the fuel supply system.

4.2.179 Functional_characteristic

A Functional_characteristic is a type of Definition (see 4.2.77) that specifies the high level concept for all the definitions (see 3.10.32) which are attributable to the functional characteristics (see 3.10.47) of a mechanical product. Within this part of ISO 10303 each Functional_characteristic is either a Design_characteristic (see 4.2.83) or an Operational_characteristic (see 4.2.341).

4.2.180 Gas_chemical_property

A Gas_chemical_property is a type of Fluid_chemical_property (see 4.2.166) that specifies the high level concept for all the chemical properties which are attributable to a gas.

The data associated with a Gas_chemical_property are the following:

- defined_for.

The defined_for specifies a set of one to many gas materials for which chemical properties have been defined. There may be more than one defined_for for a Gas_chemical_property.

4.2.181 Gas_material

A Gas_material is a type of Fluid_material (see 4.2.169) that specifies the high level concept for all the gaseous materials which need to be defined.

The data associated with a Gas_material are the following:

- gas_type.

The `gas_type` attribute specifies the type of gaseous material.

4.2.181.1 `gas_type`

The value of the `gas_type` shall be one of the following:

- `air`;
- `exhaust_gas`;
- `steam`;
- `user_defined_gas`.

4.2.181.1.1 `air`: the descriptor that specifies that the gas is air.

4.2.181.1.2 `exhaust_gas`: the descriptor that specifies that the gas is the product of combustion of fossil fuels with air.

4.2.181.1.3 `steam`: the descriptor that specifies that the gas is steam.

4.2.181.1.4 `user_defined_gas`: the descriptor, set by the user, which specifies the type of gas if different from the other options.

4.2.182 `Gas_material_requirement`

A `Gas_material_requirement` is a type of `Fluid_material_requirement` (see 4.2.170) and specifies the type and level of gas material that is needed for the operation of a mechanical product.

The data associated with a `Gas_material_requirement` are the following:

- `gas_material_details`.

The `gas_material_details` specifies the type of the gas that has to be provided by an external resource.

4.2.183 `Gas_physical_property`

A `Gas_physical_property` is a type of `Fluid_physical_property` (see 4.2.171) that specifies the high level concept for all the physical properties which are attributable to a gas.

The data associated with a `Gas_physical_property` are the following:

- `defined_for`.

The `defined_for` specifies a set of one to many gas materials for which physical properties have been defined. There may be more than one `defined_for` for a `Gas_physical_property`.

4.2.184 `Gas_turbine_engine`

A `Gas_turbine_engine` is a type of `Rotating_machinery` (see 4.2.423) and specifies the concept for all the gas turbine engines that need to be defined.

The data associated with a `Gas_turbine_engine` are the following:

- `Gas_turbine_engine_type`.

The `gas_turbine_engine_type` specifies, as text, the type of the gas turbine engine.

4.2.185 Gas_turbine_engine_composition

A `Gas_turbine_engine_composition` is a type of `Machinery_composition` (see 4.2.272) and specifies the composition (see 3.10.19) of a gas turbine engine in terms of its constituent mechanical products.

The data associated with a `Gas_turbine_engine_composition` are the following:

- `defined_for`.

The `defined_for` specifies a set of one to many gas turbine engines for which composition is defined.

4.2.186 Gas_turbine_engine_connectivity

A `Gas_turbine_engine_connectivity` is a type of `Product_connectivity` (see 4.2.382) and specifies the connectivity of a gas turbine engine in terms of its connections to the other mechanical products at its boundary.

The data associated with a `Gas_turbine_engine_connectivity` are the following:

- `defined_for`.

The `defined_for` specifies a set of one to many gas turbine engines for which connectivity is defined.

4.2.187 Gas_turbine_engine_context

A `Gas_turbine_engine_context` is a type of `Product_context` (see 4.2.383) and specifies the context, such as ship context and project context, within which the gas turbine engine is used or considered.

The data associated with a `Gas_turbine_engine_context` are the following:

- `defined_for`.

The `defined_for` specifies a set of one to many gas turbine engines for which context is defined.

4.2.188 Gas_turbine_engine_design_characteristic

A `Gas_turbine_engine_design_characteristic` is a type of `Machinery_design_characteristic` (see 4.2.273) and specifies the functional design data for a gas turbine engine.

The data associated with a `Gas_turbine_engine_design_characteristic` are the following:

- `defined_for`;
- `design_performance_data`;
- `max_turbine_inlet_temperature`.

4.2.188.1 defined_for

The `defined_for` specifies a set of one to many gas turbine engines for which design characteristics are defined.

4.2.188.2 design_performance_data

The `design_performance_data` specifies a set of `Gas_turbine_engine_performance_data` (see 4.2.197), representing the gas turbine engine functional data at a number of operating conditions. There may be more than one `design_performance_data` for a `Gas_turbine_engine_design_characteristic`.

4.2.188.3 max_turbine_inlet_temperature

The `max_turbine_inlet_temperature` specifies the maximum turbine temperature at the inlet stage as specified during design, beyond which the turbine should not be operated.

4.2.189 Gas_turbine_engine_drawing

A `Gas_turbine_engine_drawing` is a type of `Mechanical_product_drawing` (see 4.2.318) and specifies the concept for associating various types of drawings to a gas turbine engine.

The data associated with a `Gas_turbine_engine_drawing` are the following:

- `defined_for`.

The `defined_for` specifies a set of one to many gas turbine engines for which drawing is defined.

4.2.190 Gas_turbine_engine_general_characteristic

A `Gas_turbine_engine_general_characteristic` is a type of `Machinery_general_characteristic` (see 4.2.274) and specifies the gas turbine engine overall specifications and characteristics.

The data associated with a `Gas_turbine_engine_general_characteristic` are the following:

- `control_method_description`;
- `combustion_chamber_type`;
- `defined_for`;
- `fuel_injection_system_type`;
- `fuel_type`;
- `power_to_weight_ratio`.

4.2.190.1 control_method_description

The `control_method_description` specifies, as text, the method by which the gas turbine engine is controlled. The `control_method_description` need not be specified for a particular `Gas_turbine_engine_general_characteristic`.

4.2.190.2 combustion_chamber_type

The `combustion_chamber_type` specifies, as text, the type of gas turbine combustion chamber.

4.2.190.3 defined_for

The `defined_for` specifies a set of one to many gas turbine engines for which general characteristics are defined.

4.2.190.4 fuel_injection_system_type

The fuel_injection_system_type specifies, as text, the type of the fuel injection system used by the gas turbine.

4.2.190.5 fuel_type

The fuel_type specifies the type of fuel for the diesel engine.

The value of the fuel_type shall be one of the following:

- boil_off_gas;
- diesel_fuel;
- heavy_fuel_oil;
- natural_gas;
- user_defined_fuel_type.

4.2.190.5.1 boil_off_gas: the descriptor that specifies that the gas is collected on-board ships. It is the leaked gas that has been recovered.

4.2.190.5.2 diesel_fuel: the descriptor that specifies that this type of fuel represents the lighter cuts of liquid fuels used for diesel engine.

4.2.190.5.3 heavy_fuel_oil: the descriptor which specifies that this type of fuel represents the heavier cuts of liquid fuel used for diesel engines.

4.2.190.5.4 natural_gas: the descriptor which specifies that the type of fuel is natural gas.

4.2.190.5.5 user_defined_fuel_type: the descriptor, set by the user, which specifies the type of fuel if different from the other options.

4.2.190.6 power_to_weight_ratio

The power_to_weight_ratio specifies the ratio of gas turbine engine nominal power to its total weight. The power_to_weight_ratio need not be specified for a particular Gas_turbine_engine_general_characteristic.

4.2.191 Gas_turbine_engine_identification

A Gas_turbine_engine_identification is a type of Equipment_identification (see 4.2.135) and specifies the data for identification of the gas turbine engine.

The data associated with a Gas_turbine_engine_identification are the following:

- defined_for.

The defined_for specifies a set of one to many gas turbine engines for which identification is defined.

4.2.192 Gas_turbine_engine_mass_weight_inertia

A Gas_turbine_engine_mass_weight_inertia is a type of Mass_weight_inertia (see 4.2.297) and specifies the mass, weight and inertia for the gas turbine engine.

The data associated with a `Gas_turbine_engine_mass_weight_inertia` are the following:

— `defined_for`.

The `defined_for` specifies a set of one to many gas turbine engines for which mass, weight and inertia are defined.

4.2.193 Gas_turbine_engine_operational_characteristic

A `Gas_turbine_engine_operational_characteristic` is a type of `Operational_characteristic` (see 4.2.341 below) and specifies a high level concept for all the gas turbine engine-related operational data.

The data associated with a `Gas_turbine_engine_operational_characteristic` are the following:

— `defined_for`.

The `defined_for` specifies a set of one to many gas turbine engines for which operational characteristics are defined.

4.2.194 Gas_turbine_engine_operational_performance_data

A `Gas_turbine_engine_operational_performance_data` is a type of `Gas_turbine_engine_operational_characteristic` (see 4.2.193) and specifies the functional performance data for gas turbine operation.

The data associated with a `Gas_turbine_engine_operational_performance_data` are the following:

— `operational_performance_data`.

The `operational_performance_data` specifies a set of `Gas_turbine_engine_performance_data` (see 4.2.197), representing the gas turbine engine data at a number of operating conditions. There may be more than one `operational_performance_data` for a `Gas_turbine_engine_operational_performance_data`.

4.2.195 Gas_turbine_engine_overall_dimension

A `Gas_turbine_engine_overall_dimension` is a type of `Overall_dimension` (see 4.2.345) and specifies the overall length, breadth and height of the gas turbine engine.

The data associated with a `Gas_turbine_engine_overall_dimension` are the following:

— `defined_for`.

The `defined_for` specifies a set of one to many gas turbine engines for which overall dimensions are defined.

4.2.196 Gas_turbine_engine_overall_operational_data

A `Gas_turbine_engine_overall_operational_data` is a type of `Machinery_overall_operational_data` (see 4.2.275) and `Gas_turbine_engine_operational_characteristic`, and specifies the overall operational data including energy consumption and operating hours for a gas turbine engine.

4.2.197 Gas_turbine_engine_performance_data

A Gas_turbine_engine_performance_data is a type of Machinery_performance_data (see 4.2.276) and specifies the functional performance parameters for a gas turbine engine.

The data associated with a Gas_turbine_engine_performance_data are the following:

- compressor_inlet_temperature;
- compressor_pressure_ratio;
- cooling_water_data;
- exhaust_emissions;
- exhaust_system_data;
- intake_system_data ;.
- lube_oil_data;
- specific_fuel_consumption
- turbine_exhaust_temperature;
- turbine_pressure_ratio.

4.2.197.1 compressor_inlet_temperature

The compressor_inlet_temperature specifies the value of the fluid temperature at the inlet to the compressor.

4.2.197.2 compressor_pressure_ratio

The compressor_pressure_ratio specifies the ratio between the pressures at compressor outlet and inlet.

4.2.197.3 cooling_water_data

The cooling_water_data specifies a set of fluid flow data, if any, that define the cooling water conditions at various positions in the gas turbine engine. There may be more than one cooling_water_data for a Gas_turbine_engine_performance_data.

4.2.197.4 exhaust_emissions

The exhaust_emissions specifies a set of exhaust emissions data, if any, that define the composition of gases at the exit from the gas turbine engine. There may be more than one exhaust_emissions for a Gas_turbine_engine_performance_data.

4.2.197.5 exhaust_system_data

The exhaust_system_data specifies a set of fluid flow data, if any, that define the exhaust conditions at various positions in the exhaust system of the gas turbine engine. There may be more than one exhaust_system_data for a Gas_turbine_engine_performance_data.

4.2.197.6 intake_system_data

The intake_system_data specifies a set of fluid flow data, if any, that define the conditions of the fluid at the gas turbine engine intake. There may be more than one intake_system_data for a Gas_turbine_engine_performance_data.

4.2.197.7 lube_oil_data

The lube_oil_data specifies a set of fluid flow data, if any, that define the lubrication oil conditions at various positions in the gas turbine engine. There may be more than one lube_oil_data for a Gas_turbine_engine_performance_data.

4.2.197.8 specific_fuel_consumption

The specific_fuel_consumption specifies a value and unit expressing the specific fuel consumption of the given gas turbine engine. Specific fuel consumption is the ratio of mass of fuel consumed to mechanical energy produced by gas turbine engine.

4.2.197.9 turbine_exhaust_temperature

The turbine_exhaust_temperature specifies the value of the gas temperature at the gas turbine engine exhaust.

4.2.197.10 turbine_pressure_ratio

The turbine_pressure_ratio specifies the value of ratio between the pressures at turbine inlet and outlet.

4.2.198 Gas_turbine_engine_placement

A Gas_turbine_engine_placement is a type of Product_placement (see 4.2.388) and specifies the position of the gas turbine engine on the ship in terms of ship compartment and co-ordinate system.

The data associated with a Gas_turbine_engine_placement are the following:

— defined_for.

The defined_for specifies a set of one to many gas turbine engines for which placement is defined.

4.2.199 Gas_turbine_engine_status

A Gas_turbine_engine_status is a type of Product_status (see 4.2.390) and specifies the status of a gas turbine engine in terms of its life-cycle phase.

The data associated with a Gas_turbine_engine_status are the following:

— defined_for.

The defined_for specifies a set of one to many gas turbine engines for which status is defined.

4.2.200 Gas_turbine_plant

A Gas_turbine_plant is a type of Electric_power_generation_system (see 4.2.118) and specifies the concept for defining all the electric power plants that use only gas turbine engine as prime mover.

4.2.201 Gauge

A Gauge is a type of Control_component (see 4.2.43) and specifies the concept for all the gauges that need to be defined. Gauges are mainly used in control and instrumentation systems for observing a measured parameter.

4.2.202 Gear_box

A Gear_box is a type of Mechanical_equipment (see 4.2.310) and specifies the concept for all the gear boxes that need to be defined. A gear box is a housing for gears that are used to transmit power between shafts rotating at different speeds. A gear box is used in mechanical transmission systems as a means for reducing or increasing shaft speed.

The data associated with a Gear_box are the following:

- gear_box_type.

The gear_box_type specifies, as text, the type of the gear box.

4.2.203 Gear_box_composition

A Gear_box_composition is a type of Product_composition (see 4.2.379) and specifies the composition (see 3.10.19) of a gear box in terms of its constituent mechanical products.

The data associated with a Gear_box_composition are the following:

- defined_for.

The defined_for specifies a set of one to many gear boxes for which composition is defined.

4.2.204 Gear_box_connectivity

A Gear_box_connectivity is a type of Product_connectivity (see 4.2.382) and specifies the connectivity of a gear box in terms of its connections to the other mechanical products at its boundary.

The data associated with a Gear_box_connectivity are the following:

- defined_for.

The defined_for specifies a set of one to many gear boxes for which connectivity is defined.

4.2.205 Gear_box_design_characteristic

A Gear_box_design_characteristic is a type of Machinery_design_characteristic (see 4.2.273) and specifies the functional design data for a gear box.

The data associated with a Gear_box_design_characteristic are the following:

- defined_for;
- design_input_output_shaft_data.

4.2.205.1 defined_for

The defined_for specifies a set of one to many gear boxes for which design characteristics are defined.

4.2.205.2 design_input_output_shaft_data

The `design_input_output_shaft_data` specifies a set of `Mechanical_power_transmission_data` (see 4.2.313) representing the shaft functional data at a number of positions, according to design. There may be more than one `design_input_output_shaft_data` for a `Gear_box_design_characteristic`.

4.2.206 Gear_box_drawing

A `Gear_box_drawing` is a type of `Mechanical_product_drawing` (see 4.2.318) and specifies the concept for associating various types of drawings to a gear box.

The data associated with a `Gear_box_drawing` are the following:

- `defined_for`.

The `defined_for` specifies a set of one to many gear boxes for which drawing is defined.

4.2.207 Gear_box_general_characteristic

A `Gear_box_general_characteristic` is a type of `Machinery_general_characteristic` (see 4.2.274) and specifies the gear box overall specifications and characteristics.

The data associated with a `Gear_box_general_characteristic` are the following:

- `defined_for`;
- `duty_factor`;
- `gear_box_configuration`;
- `gear_type`;
- `number_of_input_shafts`;
- `number_of_output_shafts`;
- `number_of_stages`;
- `overall_ratio`.

4.2.207.1 defined_for

The `defined_for` specifies a set of one to many gear boxes for which general characteristics are defined.

4.2.207.2 duty_factor

The `duty_factor` specifies the relationship between the proposed maximum torque to an equivalent design torque based on the application's load spectrum. This factor is estimated from the proportion of time spent at each load level and is applicable mainly to applications with time varying torque gear drives.

4.2.207.3 gear_box_configuration

The `gear_box_configuration` specifies the basic mechanical configuration of the gear box.

The value of the `gear_box_configuration` shall be one of the following:

- `reduction`;
- `epicyclic`;

— user_defined.

4.2.207.3.1 reduction: the descriptor that specifies that the gear box is used to reduce the output speed relative to its input speed.

4.2.207.3.2 epicyclic: the descriptor that specifies that the gear box uses a combination of gears where the smaller one moves about inside the larger.

4.2.207.3.3 user_defined: the descriptor, set by the user, that specifies the type of gear box configuration if different from the other options.

4.2.207.4 gear_type

The gear_type specifies the type of the gears in the gear box.

The value of gear_type shall be one of the following:

— double_helical;
— single_helical;
— user_defined.

4.2.207.4.1 double_helical: the descriptor that specifies that the geometry of the gear teeth describes a double helix.

4.2.207.4.2 single_helical: the descriptor that specifies that the geometry of the gear teeth describes a single helix.

4.2.207.4.3 user_defined: the descriptor, set by the user, that specifies the type of gear if different from the other options.

4.2.207.5 number_of_input_shafts

The number_of_input_shafts specifies the number of shafts attached to the gear box and transmitting the power into the gear box.

4.2.207.6 number_of_output_shafts

The number_of_output_shafts specifies the number of shafts attached to the gear box and transmitting power out of the gear box.

4.2.207.7 number_of_stages

The number_of_stages specifies the number of gear stages used to change the speed.

4.2.207.8 overall_ratio

The overall_ratio specifies the gear box gear ratio based on the ratio of the inlet and outlet speeds of the gear box.

4.2.208 Gear_box_identification

A Gear_box_identification is a type of Equipment_identification (see 4.2.135) and specifies the data for identification of the gear box.

The data associated with a Gear_box_identification are the following:

- defined_for.

The defined_for specifies a set of one to many gear boxes for which identification is defined.

4.2.209 Gear_box_mass_weight_inertia

A Gear_box_mass_weight_inertia is a type of Mass_weight_inertia (see 4.2.297) and specifies the mass, weight and inertia for the gear box.

The data associated with a Gear_box_mass_weight_inertia are the following:

- defined_for.

The defined_for specifies a set of one to many gear boxes for which mass, weight and inertia are defined.

4.2.210 Gear_box_operational_characteristic

A Gear_box_operational_characteristic is a type of Operational_characteristic (see 4.2.341) and specifies a high level concept for all the gear box-related operational data.

The data associated with a Gear_box_operational_characteristic are the following:

- defined_for;
- operational_input_output_shaft_data.

4.2.210.1 defined_for

The defined_for specifies a set of one to many gear boxes for which operational characteristics are defined.

4.2.210.2 operational_input_output_shaft_data

The operational_input_output_shaft_data specifies a set of Mechanical_power_transmission_data (see 4.2.313), representing the shaft functional data at a number of positions during shaft operation. There may be more than one operational_input_output_shaft_data for a Gear_box_operational_characteristic.

4.2.211 Gear_box_overall_dimension

A Gear_box_overall_dimension is a type of Overall_dimension (see 4.2.345) and specifies the overall length, breadth and height of the gear box.

The data associated with a Gear_box_overall_dimension are the following:

- defined_for.

The defined_for specifies a set of one to many gear boxes for which overall dimensions are defined.

4.2.212 Gear_stage

A Gear_stage is a type of Rotating_component (see 4.2.421) and specifies the concept for all the gear stages that need to be defined. A gear stage is a pair of toothed wheels mounted on different shafts. The teeth are in contrast so that rotary motion can be transferred from one shaft to other.

4.2.213 Gear_wheel

A Gear_wheel is a type of Rotating_component (see 4.2.421) and specifies the concept for all the gear wheels that need to be defined. A gear wheel is a disc with external or internal teeth which forms one half of a gear stage.

The data associated with a Gear_wheel are the following:

- the_type.

The the_type specifies, as text, the type of the gear wheel.

4.2.214 General_event

A General_event identifies that something has happened at a certain time, activated by a certain person for a certain reason.

The data associated with a General_event are the following:

- caused_by;
- caused_when;
- description.

4.2.214.1 caused_by

The caused_by specifies the person causing an event.

4.2.214.2 caused_when

The caused_when specifies the date and time the event occurred.

4.2.214.3 description

The description specifies a textual description of significant features and reasons for the event. The description need not be specified for a particular General_event.

4.2.215 General_identifier

A General_identifier specifies the data relating to identification of a mechanical product. This entity allows for a multiple number of identifiers to be associated with a mechanical product.

The data associated with a General_identifier are the following:

- identifier;
- identifier_specifier.

4.2.215.1 identifier

The identifier specifies, as text, the unique identification assigned to a mechanical product.

4.2.215.2 identifier_specifier

The identifier_specifier identifies the organisation that has specified the identifier.

The value of identifier_specifier shall be one of the following:

- equipment_user;
- manufacturer;
- supplier;
- user_defined.

4.2.215.2.1 equipment_user: the descriptor that specifies the identifier is being used or specified by the equipment users.

4.2.215.2.2 manufacturer: the descriptor that specifies the identifier is being used or specified by the equipment manufacturers.

4.2.215.2.3 supplier: the descriptor that specifies the identifier is being used or specified by the equipment suppliers.

4.2.215.2.4 user_defined: the descriptor, set by the user, that specifies the identifier context if different from the other options.

4.2.216 Generic_component

A Generic_component is a type of Mechanical_product_component (see 4.2.316) and specifies the concept for all the generic components that need to be defined.

4.2.217 Generic_component_identification

A Generic_component_identification is a type of Product_identification (see 4.2.385) and specifies the data for identification of the generic component.

The data associated with a Generic_component_identification are the following:

- defined_for.

The defined_for specifies a set of one to many generic components for which identification is defined.

4.2.218 Generic_component_mass_weight_inertia

A Generic_component_mass_weight_inertia is a type of Mass_weight_inertia (see 4.2.297) and specifies the mass, weight and inertia for the generic component.

The data associated with a Generic_component_mass_weight_inertia are the following:

- defined_for.

The `defined_for` specifies a set of one to many generic components for which mass, weight and inertia are defined.

4.2.219 Generic_equipment

A `Generic_equipment` is a type of `Mechanical_product_equipment` (see 4.2.319) and specifies the concept for all the generic equipment that need to be defined.

The data associated with a `Generic_equipment` are the following:

- `equipment_type`.

The `equipment_type` specifies, as text, the type of the equipment.

4.2.220 Generic_equipment_dimensional_characteristic

A `Generic_equipment_dimensional_characteristic` is a type of `Overall_dimension` (see 4.2.345) and specifies the main dimensions of the equipment.

The data associated with a `Generic_equipment_dimensional_characteristic` are the following:

- `defined_for`;
- `diameter`;
- `equipment_dimensions`;
- `thickness`.

4.2.220.1 defined_for

The `defined_for` specifies a set of one to many equipment for which dimensional characteristics are defined.

4.2.220.2 diameter

The `diameter` specifies the equipment diameter. The `diameter` need not be specified for a particular `Generic_equipment_dimensional_characteristic`.

4.2.220.3 equipment_dimensions

The `equipment_dimensions` specify a set of length measures, that can be used to define equipment dimensions. There may be more than one `equipment_dimensions` for a `Generic_equipment_dimensional_characteristic`.

4.2.220.4 thickness

The `thickness` specifies the equipment thickness. The `thickness` need not be specified for a particular `Generic_equipment_dimensional_characteristic`.

4.2.221 Generic_equipment_general_characteristic

A `Generic_equipment_general_characteristic` is a type of `Equipment_general_characteristic` (see 4.2.134) and specifies the overall specifications and characteristics for the equipment.

The data associated with a `Generic_equipment_general_characteristic` are the following:

- `defined_for`;
- `equipment_capacity`;
- `equipment_input_effort`;
- `equipment_input_flow`;
- `equipment_output_effort`;
- `equipment_output_flow`.

4.2.221.1 `defined_for`

The `defined_for` specifies a set of one to many equipment for which general characteristics are defined.

4.2.221.2 `equipment_capacity`

The `equipment_capacity` specifies the capacity of the equipment expressed in terms of `Generic_measure_with_unit` (see 4.2.224). The `equipment_capacity` need not be specified for a particular `Generic_equipment_general_characteristic`.

4.2.221.3 `equipment_input_effort`

The `equipment_input_effort` specifies a generic property such as voltage for electric equipment, pressure for hydraulic equipment or temperature for heat transfer equipment, at the input to the equipment and in terms of `Generic_measure_with_unit` (see 4.2.224). The `equipment_input_effort` need not be specified for a particular `Generic_equipment_general_characteristic`.

4.2.221.4 `equipment_input_flow`

The `equipment_input_flow` specifies a generic property such as current for electric equipment, volumetric flow rate for hydraulic equipment or heat flux for heat transfer equipment, at the input to the equipment and in terms of `Generic_measure_with_unit` (see 4.2.224). The `equipment_input_flow` need not be specified for a particular `Generic_equipment_general_characteristic`.

4.2.221.5 `equipment_output_effort`

The `equipment_output_effort` specifies a generic property such as voltage for electric equipment, pressure for hydraulic equipment or temperature for heat transfer equipment, at the output from the equipment and in terms of `Generic_measure_with_unit` (see 4.2.224). The `equipment_output_effort` need not be specified for a particular `Generic_equipment_general_characteristic`.

4.2.221.6 `equipment_output_flow`

The `equipment_output_flow` specifies a generic property such as current for electric equipment, volumetric flow rate for hydraulic equipment or heat flux for heat transfer equipment, at the output from the equipment and in terms of `Generic_measure_with_unit` (see 4.2.224). The `equipment_output_flow` need not be specified for a particular `Generic_equipment_general_characteristic`.

4.2.222 `Generic_equipment_identification`

A `Generic_equipment_identification` is a type of `Equipment_identification` (see 4.2.135) and specifies the data for identification of the equipment.

The data associated with a `Generic_equipment_identification` are the following:

- `defined_for`.

The `defined_for` specifies a set of one to many equipment for which identification is defined.

4.2.223 `Generic_equipment_mass_weight_inertia`

A `Generic_equipment_mass_weight_inertia` is a type of `Mass_weight_inertia` (see 4.2.297) and specifies the mass, weight and inertia for the equipment.

The data associated with a `Generic_equipment_mass_weight_inertia` are the following:

- `defined_for`.

The `defined_for` specifies a set of one to many equipment for which mass, weight and inertia are defined.

4.2.224 `Generic_measure_with_unit`

A `Generic_measure_with_unit` is a type of `Measure_with_unit` (see 4.2.305) and specifies the value and units applied to generic properties of equipment such as equipment capacity. The qualifier attribute in `Measure_with_unit` (see 4.2.305) may be used to specify additional textual information on the generic property itself.

The data associated with a `Generic_measure_with_unit` are the following:

- `name`;
- `unit`.

4.2.224.1 `name`

The `name` specifies, as text, the name of the property for generic equipment.

4.2.224.2 `unit`

The `unit` specifies, as text, the engineering units for the property.

4.2.225 `Geometric_definition`

A `Geometric_definition` is a type of `Physical_definition` (see 4.2.348) and specifies the high level concept for all the definitions attributable to shape and various dimensional characteristics of a mechanical product. Within this part of ISO 10303 each `Geometric_definition` is either a `Mechanical_product_representation` (see 4.2.324), an `Overall_dimension` (see 4.2.345) or a `Tolerance` (see 4.2.537).

4.2.226 `Geometric_representation_item`

A `Geometric_representation_item` is an element of geometric product data that either participates in one or more representations. It is used as defined in ISO 10303-42.

4.2.227 Global_unique_identifier

A Global_unique_identifier specifies an identifier used for uniquely identifying an externally referenced entity.

The data associated with a Global_unique_identifier are the following:

- company_identification;
- company_name.

4.2.227.1 company_identification

The company_identification is a company-specific unique identification label.

4.2.227.2 company_name

The company_name is the name of the company for which company_identification is specified.

4.2.228 Grouped_property

A Grouped_property specifies the complete set of properties for a mechanical product that are normally used together as a group in practical data exchange scenarios.

The data associated with a Grouped_property are the following:

- group_properties;
- property_and_property_value.

4.2.228.1 group_properties

The group_properties specify a set of Grouped_property, representing complex data types comprising of a collection of mechanical product properties. There may be more than one group_properties for a Grouped_property.

4.2.228.2 property_and_property_value

The property_and_property_value specifies a set of Library_property_and_property_value (see 4.2.260), representing a single mechanical product property and its value. There may be more than one property_and_property_value for a Grouped_property.

4.2.229 Heat_capacity

A Heat_capacity is a type of Measure_with_unit (see 4.2.305) where the physical quantity is the heat capacity of a material.

The data associated with a Heat_capacity are the following:

- heat_capacity_unit.

The heat_capacity_unit specifies all the units which can be used for heat capacity.

4.2.230 Heat_exchanger

A Heat_exchanger is a type of Process_equipment (see 4.2.373) and specifies the concept for all the heat exchangers that need to be defined.

The data associated with a heat_exchanger are the following:

- heat_exchanger_type.

4.2.230.1 heat_exchanger_type

The heat_exchanger_type specifies the type of the heat exchanger.

The value of heat_exchanger_type shall be one of the following:

- air_cooler;
- air_heater;
- economiser;
- fuel_preheater;
- oil_cooler;
- oil_heater;
- recuperator;
- regenerator;
- user_defined_heat_exchanger_role;
- water_cooler;
- water_heater.

4.2.230.1.1 air_cooler: the descriptor that specifies the heat exchanger is used to reduce temperature of air.

4.2.230.1.2 air_heater: the descriptor that specifies the heat exchanger is used to increase temperature of air.

4.2.230.1.3 economiser: the descriptor that specifies the heat exchanger uses warm flue gases to preheat feedwater.

4.2.230.1.4 fuel_preheater: the descriptor that specifies the heat exchanger is used to increase temperature of fuel.

4.2.230.1.5 oil_cooler: the descriptor that specifies the heat exchanger is used to reduce temperature of lubricating oil.

4.2.230.1.6 oil_heater: the descriptor that specifies the heat exchanger is used to increase temperature of lubricating oil.

4.2.230.1.7 recuperator: the descriptor that specifies the heat exchanger is used to transfer heat from combustion products to a cool air.

4.2.230.1.8 regenerator: the descriptor that specifies the heat exchanger is using cool expanded gasses to cool incoming compressed gas.

4.2.230.1.9 user_defined_heat_exchanger_type: the descriptor, set by the user, that specifies the role of heat exchanger if different from the other options.

4.2.230.1.10 water_cooler: the descriptor that specifies the heat exchanger is used to reduce temperature of water.

4.2.230.1.11 water_heater: the descriptor that specifies the heat exchanger is used to increase temperature of water.

4.2.231 Heat_exchanger_composition

A `Heat_exchanger_composition` is a type of `Product_composition` (see 4.2.379) and specifies the composition (see 3.10.19) of a heat exchanger in terms of its constituent mechanical products.

The data associated with a `Heat_exchanger_composition` are the following:

- `defined_for`.

The `defined_for` specifies a set of one to many heat exchangers for which composition is defined.

4.2.232 Heat_exchanger_connectivity

A `Heat_exchanger_connectivity` is a type of `Product_connectivity` (see 4.2.382) and specifies the connectivity of a heat exchanger in terms of its connections to the other mechanical products at its boundary.

The data associated with a `Heat_exchanger_connectivity` are the following:

- `defined_for`.

The `defined_for` specifies a set of one to many heat exchangers for which connectivity is defined.

4.2.233 Heat_exchanger_context

A `Heat_exchanger_context` is a type of `Product_context` (see 4.2.383) and specifies the context, such as ship context and project context, within which the heat exchanger is used or considered.

The data associated with a `Heat_exchanger_context` are the following:

- `defined_for`.

The `defined_for` specifies a set of one to many heat exchangers for which context is defined.

4.2.234 Heat_exchanger_design_characteristic

A `Heat_exchanger_design_characteristic` is a type of `Equipment_design_characteristic` (see 4.2.133) and specifies the functional design data for a heat exchanger.

The data associated with a `Heat_exchanger_design_characteristic` are the following:

- `defined_for`;
- `design_performance_data`;

4.2.234.1 defined_for

The `defined_for` specifies a set of one to many heat exchangers for which design characteristics are defined.

4.2.234.2 design_performance_data

The `design_performance_data` specifies a set of `Heat_exchanger_performance_data` (see 4.2.242), representing the heat exchanger functional data at the number of operating conditions. There may be more than one `design_performance_data` for a `Heat_exchanger_design_characteristic`.

4.2.235 Heat_exchanger_drawing

A `Heat_exchanger_drawing` is a type of `Mechanical_product_drawing` (see 4.2.318) and specifies the concept for associating various types of drawings to a heat exchanger.

The data associated with a `Heat_exchanger_drawing` are the following:

- `defined_for`.

The `defined_for` specifies a set of one to many heat exchangers for which drawing is defined.

4.2.236 Heat_exchanger_general_characteristic

A `Heat_exchanger_general_characteristic` is a type of `Equipment_general_characteristic` (see 4.2.134) and specifies the heat exchanger overall specifications and characteristics.

The data associated with a `Heat_exchanger_general_characteristic` are the following:

- `cooled_fluid`;
- `defined_for`;
- `heated_fluid`;
- `heat_exchanger_type_by_design`.

4.2.236.1 cooled_fluid

The `cooled_fluid` specifies the type of material that is reducing in temperature while passing through the heat exchanger.

4.2.236.2 defined_for

The `defined_for` specifies a set of one to many heat exchangers for which general characteristics are defined.

4.2.236.3 heated_fluid

The `heated_fluid` specifies the type of material that is increasing in temperature while passing through the heat exchanger.

4.2.236.4 heat_exchanger_type_by_design

The `heat_exchanger_type_by_design` specifies the type of the heat exchanger according to design.

The value of `heat_exchanger_type_by_design` shall be one of the following:

- shell_and_tube_counter_flow;
- shell_and_tube_cross_flow;
- shell_and_tube_parallel_flow;
- user_defined_heat_exchanger_type.

4.2.236.4.1 shell_and_tube_counter_flow: the descriptor that specifies the heat exchanger uses two fluids that do not come in direct contact and flow in parallel but opposite directions.

4.2.236.4.2 shell_and_tube_cross_flow: the descriptor that specifies the heat exchanger uses two fluids that do not come in direct contact and flow perpendicular to each other.

4.2.236.4.3 shell_and_tube_parallel_flow: the descriptor that specifies the heat exchanger uses two fluids that do not come in direct contact and flow in parallel and in the same direction.

4.2.236.4.4 user_defined_heat_exchanger_type: the descriptor, set by the user, that specifies the type of heat exchanger according to design if different from the other options.

4.2.237 Heat_exchanger_identification

A Heat_exchanger_identification is a type of Equipment_identification (see 4.2.135) and specifies the data for identification of the heat exchanger.

The data associated with a Heat_exchanger_identification are the following:

- defined_for;

The defined_for specifies a set of one to many heat exchangers for which identification is defined.

4.2.238 Heat_exchanger_mass_weight_inertia

A Heat_exchanger_mass_weight_inertia is a type of Mass_weight_inertia (see 4.2.297) and specifies the mass, weight and inertia for the heat exchanger.

The data associated with a Heat_exchanger_mass_weight_inertia are the following:

- defined_for;
- weight_including_working_fluid.

4.2.238.1 defined_for

The defined_for specifies a set of one to many heat exchangers for which mass, weight and inertia are defined.

4.2.238.2 weight_including_working_fluid

The weight_including_working_fluid specifies the overall weight of the heat exchanger when it is filled with working fluid.

4.2.239 Heat_exchanger_operational_characteristic

A `Heat_exchanger_operational_characteristic` is a type of `Operational_characteristic` (see 4.2.341) and specifies a high level concept for all the heat exchanger-related operational data.

The data associated with a `Heat_exchanger_operational_characteristic` are the following:

- `defined_for`.

The `defined_for` specifies a set of one to many heat exchangers for which operational characteristics are defined.

4.2.240 `Heat_exchanger_operational_performance_data`

A `Heat_exchanger_operational_performance_data` is a type of `Heat_exchanger_operational_characteristic` (see 4.2.239) and specifies the functional performance data for heat exchanger operation.

The data associated with a `Heat_exchanger_operational_performance_data` are the following:

- `operational_performance_data`

The `operational_performance_data` specifies a set of `Heat_exchanger_performance_data` (see 4.2.242), representing the heat exchanger functional data at a number of operating conditions. There may be more than one `operational_performance_data` for a `Heat_exchanger_operational_performance_data`.

4.2.241 `Heat_exchanger_overall_dimension`

A `Heat_exchanger_overall_dimension` is a type of `Overall_dimension` (see 4.2.345) and specifies the overall length, breadth and height of the heat exchanger.

The data associated with a `Heat_exchanger_overall_dimension` are the following:

- `defined_for`.

The `defined_for` specifies a set of one to many heat exchangers for which overall dimensions are defined.

4.2.242 `Heat_exchanger_performance_data`

A `Heat_exchanger_performance_data` specifies the functional performance parameters for a heat exchanger.

The data associated with a `Heat_exchanger_performance_data` are the following:

- `ambient_condition`;
- `effectiveness`;
- `fluid_data_at_cooling_side`;
- `fluid_data_at_heating_side`;
- `pressure_drop`.

4.2.242.1 `ambient_condition`

The `ambient_condition` specifies the environmental conditions, such as pressure and temperature, where heat exchanger is operating.

4.2.242.2 effectiveness

The `effectiveness` specifies the heat exchanger effectiveness. Effectiveness is a measure for heat exchanger performance.

4.2.242.3 fluid_data_at_cooling_side

The `fluid_data_at_cooling_side` specifies a set of fluid flow data that define the conditions of the working fluid at cooling side. There may be more than one `fluid_data_at_cooling_side` for a `Heat_exchanger_performance_data`.

4.2.242.4 fluid_data_at_heating_side

The `fluid_data_at_heating_side` specifies a set of fluid flow data that define the conditions of the working fluid at heating side. There may be more than one `fluid_data_at_heating_side` for a `Heat_exchanger_performance_data`.

4.2.242.5 pressure_drop

The `pressure_drop` specifies the loss of pressure of the working fluid due to resistance between heat exchanger inlet and outlet.

4.2.243 Heat_exchanger_placement

A `Heat_exchanger_placement` is a type of `Product_placement` (see 4.2.388) and specifies the position of the heat exchanger on the ship in terms of ship compartment and co-ordinate system.

The data associated with a `Heat_exchanger_placement` are the following:

- `defined_for`.

The `defined_for` specifies a set of one to many heat exchangers for which placement is defined.

4.2.244 Heat_exchanger_status

A `Heat_exchanger_status` is a type of `Product_status` (see 4.2.390) and specifies the status of a heat exchanger in terms of its life-cycle phase.

The data associated with a `Heat_exchanger_status` are the following:

- `defined_for`.

The `defined_for` specifies a set of one to many heat exchangers for which status is defined.

4.2.245 Hinge

A `Hinge` is a type of `Structural_connector` (see 4.2.503) and specifies the concept for all the hinges that need to be defined. A hinge is a joining device on which an attached part swings.

4.2.246 Homogeniser

A Homogeniser is a type of Process_machinery (see 4.2.374) and specifies the concept for all the homogenisers that need to be defined. A homogeniser is a device in which substances are emulsified by being forced through an energetic shear field.

4.2.247 Human_resource

A Human_resource is a type of Task_resource (see 4.2.523) which specifies the data that relate to human resources required to perform a task.

The data associated with a Human_resource are the following:

- man_time;
- personnel.

4.2.247.1 man_time

The man_time specifies the time that would be needed/used by a single person to perform a task.

4.2.247.2 personnel

The personnel specifies the particulars of the personnel needed for carrying out the task. There may be more than one personnel for a Human_resource.

4.2.248 Impeller

An Impeller is a type of Rotating_component (see 4.2.421) and specifies the concept for all the impellers that need to be defined. An impeller is a vaned wheel of a centrifugal pump.

The data associated with an Impeller are the following:

- the_type.

The the_type specifies, as text, the type of the impeller.

4.2.249 Impurity_name_and_content

An Impurity_name_and_content specifies the type and level of impurities within a particular material.

The data associated with an Impurity_name_and_content are the following:

- impurity_content_percent;
- impurity_name.

4.2.249.1 impurity_content_percent

The impurity_content_percent specifies a percentage content of a named impurity within a particular material. The content is expressed as a real number.

4.2.249.2 impurity_name

The `impurity_name` specifies, as text, the name of the impurity within a particular material, whose quantity is being defined.

4.2.250 Inertia_moment

An `Inertia_moment` is a type of `Measure_with_unit` (see 4.2.305) where the physical quantity is the moment of inertia of something.

The data associated with an `Inertia_moment` are the following:

- `inertia_moment_unit`.

The `inertia_moment_unit` specifies all the units which can be used to specify moment of inertia.

4.2.251 Intake_manifold

An `Intake_manifold` is a type of `Mechanical_component` (see 4.2.306) and specifies the concept for all the intake manifolds that need to be defined. An intake manifold is a pipe or chamber that has multiple openings to allow passage of air from atmosphere or engine room to the cylinder or combustion chamber of an engine.

4.2.252 Integer_value

The `Integer_value` specifies that the property value is of type integer.

The data associated with a `Integer_value` are the following:

- `the_value`.

The `the_value` specifies the actual value of the property in the form of an integer number (whole number).

4.2.253 Item

An `Item` is a type of `Definable_object` (see 4.2.76) that specifies the high level concept for any of the items (see 3.10.51) which need to be defined or described. Within this part of ISO 10303 each `Item` is either a `Material` (see 4.2.298), a `Mechanical_product` (see 4.2.314), a `Product_anomaly` (see 4.2.376), a `Restricted_water` (see 4.2.418), a `Sea` (see 4.2.445), a `Sea_port` (see 4.2.446), a `Ship` (see 4.2.466), a `Shipyard` (see 4.2.477), a `Task` (see 4.2.511).

The data associated with an `Item` are the following:

- `description`;
- `documentation`;
- `identifier`;
- `name`.

4.2.253.1 description

The `description` specifies a textual description for the item.

4.2.253.2 documentation

The documentation specifies the documentation available, if any, for the item. There may be more than one documentation for an Item.

4.2.253.3 identifier

The identifier specifies a text string for unique identification of the item.

4.2.253.4 name

The name specifies, as text, the name that is commonly associated with the item.

4.2.254 Item_relationship

An Item_relationship is the supertype of Definable_object (see 4.2.76) and defines the association between two items.

The data associated with an Item_relationship are the following:

- description;
- item_one;
- item_two.

4.2.254.1 description

The description specifies the significant aspect of the relationship in the text format. The description need not be specified for a particular Item_relationship.

4.2.254.2 item_one

The item_one specifies the first Item (see 4.2.253) that forms a relationship with another Item.

4.2.254.3 item_two

The item_two specifies the second Item (see 4.2.253) that forms a relationship with another Item.

4.2.255 Item_structure

An Item_structure is a type of Definable_object (see 4.2.76) and specifies the structure of an item by specifying a set of relationships between its constituent items.

The data associated with an Item_structure are the following:

- item_relationships;
- items.

4.2.255.1 item_relationships

The item_relationships specify the relationship between items which are part of an Item_structure. There may be more than one item_relationships for an Item_structure.

4.2.255.2 items

The items specifies the particulars of products which belong to a product structure. There may be more than one item for an Item_structure.

4.2.256 Label

A Label is used to assign a character label to something. It is used as defined in ISO 10303-41.

4.2.257 Length

A Length is a type of Measure_with_unit (see 4.2.305) where the physical quantity is the length of something.

The data associated with a Length are the following:

- length_unit.

The length_unit attribute specifies all the units which can be used to specify length.

4.2.258 Library_class_identifier

A Library_class_identifier identifies the mechanical product class in an ISO 13584 compliant data dictionary by reference to a Class_BSU (see 4.2.31).

The data associated with a Library_class_identifier are the following:

- class_bsu.

The class_bsu specifies the identification information for the type of mechanical product.

4.2.259 Library_element_reference

A Library_element_reference specifies the complete set of information for referencing an instance of a mechanical product in an ISO 13584 compliant data library.

The data associated with a Library_element_reference are the following:

- class_identifier;
- property_value_pairs.

4.2.259.1 class_identifier

The class_identifier specifies the identification information for type of mechanical product.

4.2.259.2 property_value_pairs

The property_value_pairs specify a set of Library_property_and_property_value (see 4.2.260), representing the mechanical product properties and their values. These properties and their values are used to select an instance of the mechanical product from an ISO 13584 compliant data library. There may be more than one property_value_pairs for a Library_element_reference.

4.2.260 Library_property_and_property_value

A `Library_property_and_property_value` specifies a property (see ISO13584-24 for definition of property) and its value.

The data associated with a `Library_property_and_property_value` are the following:

- `property_bsu`;
- `property_value`.

4.2.260.1 property_bsu

The `property_bsu` specifies the identification information for type of property by reference to a `Property_BSU` (see 4.2.392).

4.2.260.2 property_value

The `property_value` specifies the type of the value assigned to the property.

4.2.261 Lifting_equipment

A `Lifting_equipment` is a type of `Mechanical_product_equipment` (see 4.2.319) that specifies the high level concept for all the lifting equipment which needs to be defined.

4.2.262 Linear_damping_coefficient

A `Linear_damping_coefficient` is a type of `Measure_with_unit` (see 4.2.305) where the physical quantity is linear damping coefficient. In an oscillating system subject to viscous damping, the linear damping coefficient is defined as the force resisting the motion per unit velocity.

A data associated with a `Linear_damping_coefficient` are the following:

- `linear_damping_coefficient_unit`.

The `linear_damping_coefficient_unit` specifies all the units that can be used for quantifying the linear damping coefficient.

4.2.263 Linear_stiffness

A `Linear_stiffness` is a type of `Measure_with_unit` (see 4.2.305) where the physical quantity is the material stiffness. In a mechanical vibrating system, linear stiffness is the restoring force per unit length deflection.

A data associated with a `Linear_stiffness` are the following:

- `linear_stiffness_unit`.

The `linear_stiffness_unit` specifies all the units that can be used for quantifying the linear stiffness.

4.2.264 Liquid_chemical_property

A Liquid_chemical_property is a type of Fluid_chemical_property (see 4.2.166) and specifies the chemical properties of the liquid material.

The data associated with a Liquid_chemical_property are the following:

- defined_for.

The defined_for specifies a set of one to many liquid materials for which chemical properties are specified.

4.2.265 Liquid_material

A Liquid_material is a type of Fluid_material (see 4.2.169) that specifies the concept for all the liquid materials that need to be defined.

The data associated with a Liquid_material are the following:

- liquid_type.

4.2.265.1 liquid_type

The liquid_type specifies the type of liquid material.

The value of the liquid_type shall be one of the following:

- fuel_oil;
- gas_oil;
- lubrication_oil;
- user_defined_liquid;
- water.

4.2.265.1.1 fuel_oil: the descriptor which specifies that the liquid is heavy fuel oil.

4.2.265.1.2 gas_oil: the descriptor which specifies that the liquid is diesel fuel oil.

4.2.265.1.3 lubrication_oil: the descriptor which specifies that the liquid is lubrication oil.

4.2.265.1.4 user_defined_liquid: the descriptor, set by the user, if the type of liquid is different from the other options.

4.2.265.1.5 water: the descriptor which specifies that the liquid is water.

4.2.266 Liquid_material_requirement

A Liquid_material_requirement is a type of Fluid_material_requirement (see 4.2.170) and specifies the type and level of liquid material that is needed for the operation of a mechanical product.

The data associated with a Liquid_material_requirement are the following:

- liquid_material_details;
- maximum_allowed_pressure_drop.

4.2.266.1 liquid_material_details

The liquid_material_details specifies the type of the liquid that has to be provided by an external resource.

4.2.266.2 maximum_allowed_pressure_drop

The maximum_allowed_pressure_drop specifies the maximum pressure loss allowed within the system. The maximum_allowed_pressure_drop need not be specified for a particular Liquid_material_requirement.

4.2.267 Liquid_physical_property

A Liquid_physical_property is a type of Fluid_physical_property (see 4.2.171) that specifies the high level concept for all the physical properties that are attributable to a liquid.

The data associated with a Liquid_physical_property are the following:

- defined_for;
- flash_point;
- pour_point;
- surface_tension.

4.2.267.1 defined_for

The defined_for specifies a set on one to many liquid materials for which the physical properties are defined.

4.2.267.2 flash_point

The flash_point specifies the liquid flash point, the lowest temperature at which vapour above a volatile liquid will ignite by flame.

4.2.267.3 pour_point

The pour_point attribute specifies the liquid pour point, the minimum temperature at which a liquid will flow.

4.2.267.4 surface_tension

The surface_tension specifies the liquid surface tension at reference temperature.

4.2.268 Local_co_ordinate_system

A Local_co_ordinate_system is used to specify the location of something in space. A Local_co_ordinate_system is always defined with respect to another coordinate system, this might be the global coordinate system or another local coordinate system.

NOTE 1 the local axes directions are called U, V, W. The local W-direction is normal to the plane, defined by local_u and local_v

NOTE 2 a local coordinate system shall form a right handed system.

The data associated with a `Local_coordinate_system` are the following:

- `local_u`;
- `local_v`;
- `local_w`;
- `parent_to_coordinate_system`;
- `u_value`;
- `v_value`;
- `w_value`.

4.2.268.1 `local_u`

The `local_u` specifies the local axis, defined in the underlying coordinate system, global or local.

4.2.268.2 `local_v`

The `local_v` specifies the local axis perpendicular to `local_u`, defined in the underlying coordinate system, global or local.

4.2.268.3 `local_w`

The `local_w` specifies the local axis perpendicular to `local_u` and `local_v`, defined in the underlying coordinate system, global or local.

4.2.268.4 `parent_to_coordinate_system`

The `parent_to_coordinate_system` specifies the underlying coordinate system which serves as definition space for this coordinate system. The parent coordinate system will be specified in text format.

4.2.268.5 `u_value`

The `u_value` specifies the coordinate for the origin, value along parent u-axis.

4.2.268.6 `v_value`

The `v_value` specifies the coordinate for the origin, value along parent v-axis.

4.2.268.7 `w_value`

The `w_value` specifies the coordinate for the origin, value along parent w-axis.

4.2.269 `Logical_value`

The `Logical_value` specifies that the property value is of type logical.

The data associated with a `Logical_value` are the following:

- `the_value`.

The `the_value` specifies the actual value of the property in the form of a logical value (true or false).

4.2.270 Lubrication_system

A Lubrication_system is a type of Machinery_piping_system (see 4.2.277) and specifies the concept for all the machinery lubrication systems that need to be defined.

The data associated with a Lubrication_system are the following:

- system_type.

The system_type specifies, as text, the type of the lubrication system.

4.2.271 Machinery

A Machinery is a type of Mechanical_product_equipment (see 4.2.319) and specifies the high level concept for all types of machinery (see 3.10.56) that need to be defined. Within this part of ISO 10303 each Machinery is either an Electrical_machinery (see 4.2.124), a Mechanical_machinery (see 4.2.312) or a Process_machinery (see 4.2.374).

4.2.272 Machinery_composition

A Machinery_composition is a type of Product_composition (see 4.2.379) and specifies the composition (see 3.10.19) of a machinery (see 3.10.56) in terms of its constituent mechanical products.

The data associated with a Machinery_composition are the following:

- defined_for.

The defined_for specifies a set of one to many instances of machinery for which composition is defined.

4.2.273 Machinery_design_characteristic

A Machinery_design_characteristic is a type of Equipment_design_characteristic (see 4.2.133) and specifies the functional design data which are attributable to all types of machinery. Within this part of ISO 10303 each Machinery_design_characteristic is either a Diesel_engine_design_characteristic (see 4.2.91), an Electric_generator_design_characteristic (see 4.2.111), an Electric_motor_design_characteristic (see 4.2.115), a Gas_turbine_engine_design_characteristic (see 4.2.188), a Gear_box_design_characteristic (see 4.2.205), a Pump_design_characteristic (see 4.2.399) or a Shaft_design_characteristic (see 4.2.455).

The data associated with a Machinery_design_characteristic are the following:

- defined_for;
- machinery_utility_requirement_design;
- overload_characteristics.

4.2.273.1 defined_for

The defined_for specifies a set of one to many machinery for which the machinery design characteristics are defined.

4.2.273.2 machinery_utility_requirement_design

The `machinery_utility_requirement_design` specifies a set of utility requirements such as electricity, gas, air and water that are needed in order to operate the machinery. These utility requirements are specified at the design stage of machinery.

4.2.273.3 `overload_characteristics`

The `overload_characteristics` specifies, as text, the level of overload that machinery can tolerate.

4.2.274 `Machinery_general_characteristic`

A `Machinery_general_characteristic` is a type of `Equipment_general_characteristic` (see 4.2.134) and specifies the high level concept for the general characteristics data that need to be attributed to all types of machinery. Within this part of ISO 10303 each `Machinery_general_characteristic` is either a `Diesel_engine_general_characteristic` (see 4.2.94), an `Electric_generator_general_characteristic` (see 4.2.112), an `Electric_motor_general_characteristic` (see 4.2.116), a `Gas_turbine_engine_general_characteristic` (see 4.2.190) or a `Gear_box_general_characteristic` (see 4.2.207).

The data associated with a `Machinery_general_characteristic` are the following:

- `defined_for`;
- `direction_of_rotation`;
- `lube_oil_system_type`;
- `method_of_cooling`.

4.2.274.1 `defined_for`

The `defined_for` specifies a set of one to many machinery for which general characteristics are defined.

4.2.274.2 `direction_of_rotation`

The `direction_of_rotation` specifies the machinery direction of rotation.

The value of `direction_of_rotation` shall be one of the following:

- `anti_clockwise`;
- `clockwise`.

4.2.274.2.1 `anti_clockwise`: The descriptor which specifies that the machinery rotates anti-clockwise when viewed from the left.

4.2.274.2.2 `clockwise`: The descriptor which specifies that the machinery rotates clockwise.

NOTE the clockwise and anti-clockwise for a prime mover is specified while viewing the machinery from the output coupling towards the machinery and for a driven machinery is specified while viewing the machinery from the input coupling towards the machinery.

4.2.274.3 `lube_oil_system_type`

The `lube_oil_system_type` specifies, as text, the type of machinery lubrication system.

4.2.274.4 `method_of_cooling`

The `method_of_cooling` specifies the cooling method applied to the machinery.

The value of `method_of_cooling` shall be one of the following:

- `air_cooled`;
- `user_defined`;
- `water_cooled`.

4.2.274.4.1 `air_cooled`: the descriptor that specifies that the machinery is cooled by air.

4.2.274.4.2 `user_defined`: the descriptor, set by the user, which specifies the machinery cooling method if different from the other options.

4.2.274.4.3 `water_cooled`: the descriptor that specifies that the machinery is cooled by water.

4.2.275 Machinery_overall_operational_data

A `Machinery_overall_operational_data` is a type of `Mechanical_product_property` (see 4.2.322) that specifies the overall operational data which are attributable to all kinds of machinery.

The data associated with a `Machinery_overall_operational_data` are the following:

- `accumulated_operation_counter`;
- `accumulated_shaft_energy`;
- `operation_counter`.

4.2.275.1 accumulated_operation_counter

The `accumulated_operation_counter` specifies the total number of clock counter that the machinery has done so far in its lifecycle.

4.2.275.2 accumulated_shaft_energy

The `accumulated_shaft_energy` specifies the total energy provided or consumed by the machinery at its output/input shaft so far in its lifecycle. The `accumulated_shaft_energy` need not be specified for a particular `Machinery_overall_operational_data`.

4.2.275.3 operation_counter

The `operation_counter` attribute specifies the details of the machinery counter indicating the value of the counter at the time of reading.

4.2.276 Machinery_performance_data

A `Machinery_performance_data` is a type of `Mechanical_product_property` (see 4.2.322) that specifies a machinery operating point in terms of machinery power, rotational speed and efficiency. Within this part of ISO 10303 each `Machinery_performance_data` is either a `Diesel_engine_performance_data` (see 4.2.101), a `Gas_turbine_engine_performance_data` (see 4.2.197), a `Pump_performance_data` (see 4.2.409) or a `Screw_propeller_erformance_data` (see 4.2.442).

The data associated with a `Machinery_performance_data` are the following:

- ambient_condition;
- efficiency;
- power;
- rotational_speed.

4.2.276.1 ambient_condition

The ambient_condition specifies the ambient condition such as pressure and temperature for the operating point.

4.2.276.2 efficiency

The efficiency specifies the machinery efficiency at the operating point.

4.2.276.3 power

The power specifies the machinery power at the operating point.

4.2.276.4 rotational_speed

The rotational_speed specifies the machinery rotational speed at the operating point.

4.2.277 Machinery_piping_system

A Machinery_piping_sytem is a type of Mechanical_system (see 4.2.326) that provides the concept for all the piping systems that need to be defined.

The data associated with a Machinery_piping_system are the following:

- piping_system_type.

4.2.277.1 piping_system_type

The piping_system_type specifies the type of the piping system.

The value of piping_system_type shall be one of the following:

- bilge_water_system;
- compressed_air_system;
- cooling_water_system;
- fresh_water_system;
- fuel_injection_system;
- fuel_oil_system;
- lube_oil_system;
- user_defined_piping_system.

4.2.277.1.1 bilge_water_system: the descriptor which specifies that the piping system is a bilge water system.

4.2.277.1.2 compressed_air_system: the descriptor which specifies that the piping system is a compressed air system.

4.2.277.1.3 cooling_water_system: the descriptor which specifies that the piping system is a cooling water system.

4.2.277.1.4 fresh_water_system: the descriptor which specifies that the piping system is a ship fresh water system.

4.2.277.1.5 fuel_injection_system: the descriptor which specifies that the piping system is a fuel injection system.

4.2.277.1.6 fuel_oil_system: the descriptor which specifies that the piping system is a fuel oil supply system.

4.2.277.1.7 lube_oil_system: the descriptor which specifies that the piping system is a lubrication system.

4.2.277.1.8 user_defined_piping_system: the descriptor, set by the user, which specifies the type of piping system if different from the other options.

4.2.278 Machinery_utility_requirement

The Machinery_utility_requirement specifies the utility requirements for a machinery, that need to be provided by external resources.

The data associated with a Machinery_utility_requirement are the following:

- cooling_water_requirement;
- electricity_requirement;
- instrument_air_requirement;
- steam_requirement;
- working_gas_requirement;
- working_liquid_requirement.

4.2.278.1 cooling_water_requirement

The cooling_water_requirement specifies a set of zero to many Liquid_material_requirement (see 4.2.266) that specify the machinery requirement for cooling water. There may be more than one cooling_water_requirement for each Machinery_utility_requirement.

4.2.278.2 electricity_requirement

The electricity_requirement specifies a set of zero to many Electrical_requirement (see 4.2.125) that specify the machinery requirement for electrical energy. There may be more than one electricity_requirement for each Machinery_utility_requirement.

4.2.278.3 instrument_air_requirement

The instrument_air_requirement specifies a set of zero to many Gas_material_requirement (see 4.2.182) that specify the machinery requirement for purified and pressurised air for operating the corresponding instruments. There may be more than one instrument_air_requirement for each Machinery_utility_requirement.

4.2.278.4 steam_requirement

The `steam_requirement` specifies a set of zero to many `Gas_material_requirement` (see 4.2.182) that specify the machinery requirement for steam. There may be more than one `steam_requirement` for each `Machinery_utility_requirement`.

4.2.278.5 working_gas_requirement

The `working_gas_requirement` specifies a set of zero to many `Gas_material_requirement` (see 4.2.182) that specify the machinery requirement for a gaseous working fluid. There may be more than one `working_gas_requirement` for each `Machinery_utility_requirement`.

4.2.278.6 working_liquid_requirement

The `working_liquid_requirement` specifies a set of zero to many `Liquid_material_requirement` (see 4.2.266) that specify the machinery requirement for a liquid working fluid. There may be more than one `working_liquid_requirement` for each `Machinery_utility_requirement`.

4.2.279 Maintainability_characteristic

A `Maintainability_characteristic` is a type of `RAM_characteristic` (see 4.2.413) that specifies the data that are attributable to the maintainability performance (see 3.7) of a mechanical product.

The data associated with a `Maintainability_characteristic` are the following:

- `maintainability`;
- `mean_logistic_delay`;
- `mean_maintenance_man_hour`;
- `mean_time_to_repair`;
- `related_maintenance_action`.

4.2.279.1 maintainability

The `maintainability` specifies the probability that the given `related_maintenance_action` can be completed within a stated time interval.

4.2.279.2 mean_logistic_delay

The `mean_logistic_delay` specifies the level of delays due to logistical problems for the `related_maintenance_action`.

4.2.279.3 mean_maintenance_man_hour

The `mean_maintenance_man_hour` specifies the level of expected man-hours for the `related_maintenance_action`.

4.2.279.4 mean_time_to_repair

The `mean_time_to_repair` specifies the maintainability performance of a product in terms of its expected/actual mean time to repair.

4.2.279.5 related_maintenance_action

The related_maintenance_action specifies the type of maintenance action for which the maintainability characteristics are defined.

4.2.280 Maintenance_configuration_data

A Maintenance_configuration_data is a type of Task_configuration (see 4.2.514) that specifies the configuration (see 3.10.23) for a maintenance task.

The data associated with the Maintenance_configuration_data are the following:

- defined_for;
- maintenance_class_by_discipline;
- maintenance_type;

4.2.280.1 defined_for

The defined_for specifies a set of one to many maintenance tasks for which configuration data are defined.

4.2.280.2 maintenance_class_by_discipline

The maintenance_class_by_discipline specifies the classification of maintenance by engineering discipline.

The value of maintenance_class_by_discipline shall be one of the following:

- electrical;
- electronic;
- mechanical;
- user_defined_discipline.

4.2.280.2.1 electrical: the descriptor that specifies that the maintenance relates to the electrical aspect of the product.

4.2.280.2.2 electronic: the descriptor that specifies that the maintenance relates to the electronic aspect of the product.

4.2.280.2.3 mechanical: the descriptor that specifies that the maintenance relates to the mechanical aspect of the product.

4.2.280.2.4 user_defined_discipline: the descriptor, to be set by the user, which specifies the maintenance related engineering discipline, if different from the other options.

4.2.280.3 maintenance_type

The maintenance_type specifies the type of maintenance.

The value of maintenance_type shall be one of the following:

- corrective_planned;

- corrective_unplanned;
- preventive_condition_based;
- preventive_time_based.

4.2.280.3.1 corrective_planned: the descriptor which specifies that the maintenance is of type corrective maintenance (see 3.7) performed on an item that has consciously been selected for breakdown maintenance (see 3.10.11).

4.2.280.3.2 corrective_unplanned: the descriptor which specifies that the maintenance is of type corrective maintenance (see 3.7) performed on an item that has not been selected for breakdown maintenance (see 3.10.11).

4.2.280.3.3 preventive_condition_based: the descriptor which specifies that the maintenance is of type preventive maintenance (see 3.7), carried out not in accordance with an established time schedule or established number of units in use, but after reception of an indication regarding the state and condition of an item.

4.2.280.3.4 preventive_time_based: the descriptor which specifies that the maintenance is of type preventive maintenance (see 3.7), carried out in accordance with an established time schedule or established number of units in use.

4.2.281 Maintenance_cost

A Maintenance_cost is a type of Task_cost (see 4.2.515) and specifies the cost associated with a maintenance task.

The data associated with a Maintenance_cost are the following:

- defined_for.

The defined_for specifies a set of one to many Maintenance_task (see 4.2.290) for which cost is specified.

4.2.282 Maintenance_failure_relationship

A Maintenance_failure_relationship defines a relationship between a Failure (see 4.2.149) and a Maintenance_task (see 4.2.290) and also specifies extra information, if any, about this relationship.

The data associated with a Maintenance_failure_relationship are the following:

- related_failure;
- related_maintenance.

4.2.282.1 related_failure

The related_failure specifies a particular Failure (see 4.2.149) that is a part of the relationship with a particular maintenance task.

4.2.282.2 related_maintenance

The related_maintenance specifies a particular Maintenance_task (see 4.2.290) that is a part of the relationship with a particular failure.

4.2.283 Maintenance_human_resource

A Maintenance_human_resource is a type of Human_resource (see 4.2.247) that specifies the human resources needed to perform the maintenance task.

The data associated with a Maintenance_resource are the following:

- defined_for.

The defined_for specifies a set of one to many maintenance tasks for which human resources need to be defined.

4.2.284 Maintenance_item

A Maintenance_item specifies a mechanical product that is the subject of a maintenance task.

The data associated with a Maintenance_item are the following:

- condition_before_maintenance;
- maintenance_item_select.

4.2.284.1 condition_before_maintenance

The condition_before_maintenance specifies, as text, the actual condition of the maintenance item before the execution of the maintenance task. The condition_before_maintenance need not be specified for a particular Maintenance_item.

4.2.284.2 maintenance_item_select

The maintenance_item_select specifies a particular mechanical product (see 3.10.61) by selecting from a list of options.

4.2.285 Maintenance_item_relationship

A Maintenance_item_relationship defines a relationship between a Maintenance_item (see 4.2.284) and a Maintenance_task (see 4.2.290) and also specifies extra information, if any, about this relationship.

The data associated with a Maintenance_item_relationship are the following:

- related_maintenance;
- related_maintenance_item.

4.2.285.1 related_maintenance

The related_maintenance specifies a particular Maintenance_task (see 4.2.290) that is a part of the relationship with a particular item.

4.2.285.2 related_maintenance_item

The related_maintenance_item specifies a particular Maintenance_item (see 4.2.284) that is a part of the relationship with a particular maintenance task.

4.2.286 Maintenance_procedure

A Maintenance_procedure is a type of Task_procedure (see 4.2.520) that specifies the procedures for carrying out a maintenance task.

The data associated with a Maintenance_procedure are the following:

- defined_for.

The defined_for specifies a set of one to many maintenance tasks for which maintenance procedures need to be defined.

4.2.287 Maintenance_result

A Maintenance_result is a type of Task_result (see 4.2.524) that specifies the results of a maintenance task.

The data associated with a Maintenance_result are the following:

- defined_for;
- results_in_keywords.

4.2.287.1 defined_for

The defined_for attribute specifies a set of one to many maintenance tasks for which maintenance results need to be defined.

4.2.287.2 results_in_keywords

The results_in_keywords specifies the result of maintenance action in keywords.

The value of results_in_keywords shall be one of the following:

- completed_approved;
- user_defined.

4.2.287.2.1 completed_approved: the descriptor that specifies that the maintenance was completed and approved.

4.2.287.2.2 user_defined: the descriptor, set by the user, which specifies the maintenance results in keywords, if different from the other options.

4.2.288 Maintenance_schedule

A Maintenance_schedule is a type of Task_schedule (see 4.2.525) which specifies the schedule needed for a maintenance task.

The data associated with a Maintenance_schedule are the following:

- defined_for.

The `defined_for` specifies a set of one to many maintenance tasks for which the schedule needs to be defined.

4.2.289 Maintenance_spare_part

A `Maintenance_spare_part` is a type of `Spare_part` (see 4.2.488) that specifies the spare parts needed for a maintenance task.

The data associated with a `Maintenance_spare_part` are the following:

- `defined_for`.

The `defined_for` specifies a set of one to many maintenance tasks for which the spare parts need to be defined.

4.2.290 Maintenance_task

A `Maintenance_task` is a type of `Task` (see 4.2.511) that specifies the concept for all the maintenance tasks (see 3.10.97) which need to be defined.

The data associated with a `Maintenance_task` are the following:

- `maintenance_action`.

4.2.290.1 maintenance_action

The `maintenance_action` specifies the type of a maintenance in terms of the main activity that characterises the maintenance task.

The value of `maintenance_action` shall be one of the following:

- `adjust`;
- `check`;
- `inspection`;
- `monitoring`;
- `overhaul`;
- `refit`;
- `repair`;
- `replace`;
- `service`;
- `test`;
- `user_defined_action`.

4.2.290.1.1 adjust: the descriptor which specifies that the main activity of the maintenance task is the adjustment of a product or its components.

4.2.290.1.2 check: the descriptor which specifies that the main activity of the maintenance task is the checking of a product or its components

4.2.290.1.3 inspection: the descriptor which specifies that the main activity of the maintenance task is the inspection of a product or its components.

4.2.290.1.4 overhaul: the descriptor which specifies that the main activity of the maintenance task is the complete overhaul of a product or its components.

4.2.290.1.5 refit: the descriptor which specifies that the main activity of the maintenance task is the refit of a product or its components.

4.2.290.1.6 repair: the descriptor which specifies that the main activity of the maintenance task is the repair of a product or its components.

4.2.290.1.7 replace: the descriptor which specifies that the main activity of the maintenance task is the replacement of a product or its components.

4.2.290.1.8 service: the descriptor which specifies that the main activity of the maintenance task is to service a product or its components.

4.2.290.1.9 test: the descriptor which specifies that the main activity of the maintenance task is to test a product or its components

4.2.290.1.10 user_defined_action: the descriptor, set by the user, which specifies the maintenance action, if different from the other options.

4.2.291 Maintenance_time

A Maintenance_time is a type of Task_time (see 4.2.526) and defines the important time durations as defined for a maintenance task.

The data associated with a Maintenance_time are the following:

— defined_for.

The defined_for specifies a set of one to many maintenance tasks for which the time durations are defined.

4.2.292 Maintenance_tool

A Maintenance_tool is a type of Tool (see 4.2.538) and defines the tools used to carry out a maintenance task

The data associated with a Maintenance_tool are the following:

— defined_for.

The defined_for specifies a set of one to many maintenance tasks for which tools are defined.

4.2.293 Manoeuvring_system

A Manoeuvring_system is a type of Mechanical_system (see 4.2.326) that specifies the concept for all the ship manoeuvring systems that need to be defined. A manoeuvring system is used to perform planned movement or change from the straight steady course and speed of a ship

The data associated with a Manoeuvring_system are the following:

— Manoeuvring_system_type.

The `manoeuvring_system_type` specifies, as text, the type of the manoeuvring system.

4.2.294 Manufacturing_characteristic

A `Manufacturing_characteristic` is a type of `Definition` (see 4.2.77) and specifies the data relating to manufacturing process of mechanical products.

The data associated with a `Manufacturing_characteristic` are the following:

- `manufacturing_process_description`.

The `manufacturing_process_description` specifies, as text, the important aspects of the product manufacturing method and processes.

4.2.295 Mass

A `Mass` is a type of `Measure_with_unit` (see 4.2.305) where the physical quantity is a mass as defined in ISO 31 (clause 2).

The data associated with a `Mass` are the following:

- `mass_unit`.

The `mass_unit` specifies all the units which can be used for mass.

4.2.296 Mass_flow

A `Mass_flow` is a type of `Measure_of_unit` (see 4.2.305) where the physical quantity is the mass flow.

The data associated with an `Mass_flow` are the following:

- `mass_flow_unit`.

The `mass_flow_unit` specifies all the engineering units which can be used for mass flow.

4.2.297 Mass_weight_inertia

A `Mass_weight_inertia` is a type of `Physical_definition` (see 4.2.348) that specifies the concept for all the definitions (see 3.10.32) which are attributable to mass, weight and inertia of the mechanical product.

The data associated with a `Mass_weight_inertia` are the following:

- `centre_of_gravity`;
- `defined_for`;
- `inertia`;
- `mass`;
- `weight`.

4.2.297.1 centre_of_gravity

The `centre_of_gravity` specifies the centre of gravity of the mechanical product as a point in a cartesian coordinate system. The `centre_of_gravity` need not be specified for a particular `Mass_weight_inertia`.

4.2.297.2 defined_for

The `defined_for` specifies a set of one to many mechanical products for which mass, weight, inertia and centre of gravity are defined.

4.2.297.3 inertia

The `inertia` specifies the moment of inertia (see 3.10.50) of the mechanical product, if applicable. The `inertia` need not be specified for a particular `Mass_weight_inertia`.

4.2.297.4 mass

The `mass` specifies the mass of the mechanical product.

4.2.297.5 weight

The `weight` specifies the weight of the mechanical product and is derived from mass.

4.2.298 Material

A `Material` is a type of `Item` (see 4.2.253) that specifies the general data that are attributable to all types of materials. Within this part of ISO 10303 each `Material` is either a `Fluid_material` (see 4.2.169) or a `Solid_material` (see 4.2.484).

The data associated with a `Material` are the following:

- `material_code`;
- `name`.

4.2.1.1 material_code

The `material_code` attribute specifies an identification code for the material in the form of a label. A `material_code` need not be specified for a particular `Material`.

4.2.1.2 name

The `name` attribute specifies the name of the material in the form of a label.

4.2.299 Material_chemical_property

A `Material_chemical_property` is a type of `Material_property` (see 4.2.303) that specifies the chemical properties of a gas. Within this part of ISO 10303 each `Material_chemical_property` is either a `Fluid_chemical_property` (see 4.2.166) or a `Solid_chemical_property` (see 4.2.482).

The data associated with a `Gas_chemical_property` are the following:

- heating_value;
- mean_molecular_weight.

4.2.299.1 heating_value

The heating_value specifies the heating value of the material. Heating value is used for combustion analysis. There may be more than one heating value for a Material_chemical_property.

4.2.299.2 mean_molecular_weight

The mean_molecular_weight specifies the mean molecular weight of the gas.

4.2.300 Material_composition

A Material_composition is a type of Material_property (see 4.2.303) that specifies the chemical composition for a material.

The data associated with a Material_composition are the following:

- composition_by_element;
- other_composition.

4.2.300.1 composition_by_element

The composition_by_element specifies the composition of the gas in terms of its chemical elements. There may be more than one composition_by_element for a Material_composition.

4.2.300.2 other_composition

The other_composition attribute specifies, as text, the material composition in terms of its constituents.

4.2.301 Material_impurities_definition

A Material_impurities_definition is a type of Material_property (see 4.2.303) and specifies the concept for defining material impurities.

The data associated with a Material_impurities_definition are the following:

- impurities;
- impurity_type.

4.2.301.1 impurities

The impurities attribute specifies a set of zero to many Impurity_name_and_content (see 4.2.249) which are used to identify and quantify the material impurities.

4.2.301.2 impurity_type

The impurity_type specifies the type of an impurity.

The value of impurity_type shall be one of the following:

- gaseous;
- liquid;
- metallic;
- solid;
- user_defined_impurity_type.

4.2.301.2.1 gaseous: the descriptor that specifies the impurity is in gaseous state.

4.2.301.2.2 liquid: the descriptor that specifies the impurity is in liquid state.

4.2.301.2.3 metallic: the descriptor that specifies the impurity is of type metal.

4.2.301.2.4 solid: the descriptor that specifies the impurity is in solid state.

4.2.301.2.5 user_defined_impurity_type: the descriptor, set by the user, that specifies the type of impurity if different from the other options.

4.2.302 Material_physical_property

A `Material_physical_property` is a type of `Material_property` (see 4.2.303) and specifies the concept for defining physical properties of materials.

The data associated with a `Material_physical_property` are the following:

- density;
- heat_capacity;
- thermal_conductivity.

4.2.302.1 density

The density specifies the density of the material.

4.2.302.2 heat_capacity

The heat_capacity specifies the heat capacity of the material.

4.2.302.3 thermal_conductivity

The thermal_conductivity specifies the thermal conductivity of the material.

4.2.303 Material_property

A `Material_property` is a type of `Definition` (see 4.2.77) that specifies the high level concept and data for all types of material properties. Within this part of ISO 10303, each `Material_property` is either a `Material_physical_property` (see 4.2.302), a `Material_chemical_property` (see 4.2.299), a `Material_composition` (see 4.2.300) or a `Material_impurities_definition` (see 4.2.301).

The data associated with a `Material_property` are the following:

- defined_for;

The `defined_for` specifies a set of one to many materials for which properties are defined.

4.2.304 Material_requirement

A `Material_requirement` is a type of `External_resources_requirement` (see 4.2.147) and specifies the concept for all the material requirements such as air, water and fuel that need to be supplied during operation of a mechanical product.

4.2.305 Measure_with_unit

A `Measure_with_unit` is the specification of a physical quantity as defined in ISO 31 (clause 2). Each `Measure_with_unit` may be one of the following: a `Density` (see 4.2.81), a `Dilatation` (see 4.2.104), an `Electrical_current` (see 4.2.122), an `Energy` (see 4.2.129), and `Energy_per_mass` (see 4.2.130), a `Force` (see 4.2.173), a `Frequency` (see 4.2.174), a `Heat_capacity` (see 4.2.229), an `Inertia_moment` (see 4.2.250), a `Length` (see 4.2.257), a `Linear_damping_coefficient` (see 4.2.262), a `Linear_stiffness` (see 4.2.263), a `Mass` (see 4.2.295), a `Mass_flow` (see 4.2.296), a `Molecular_weight` (see 4.2.334), a `Plane_angle` (see 4.2.360), a `Power` (see 4.2.365), a `Pressure` (see 4.2.366), a `Ratio` (see 4.2.414), a `Rotational_damping_coefficient` (see 4.2.424), a `Rotational_speed` (see 4.2.425), a `Rotational_stiffness` (see 4.2.426), a `Specific_fuel_consumption` (see 4.2.490), a `Speed` (see 4.2.491), a `Stress` (see 4.2.499), a `Surface_tension` (see 4.2.506), a `Temperature` (see 4.2.527), a `Thermal_conductivity` (see 4.2.533), a `Time` (see 4.2.534), a `Torque` (see 4.2.539), a `Viscosity` (see 4.2.550), a `Voltage` (see 4.2.551) or a `Volume_flow` (see 4.2.552).

The data associated with a `Measure_with_unit` are the following:

- `measure_value`;
- `qualifier`.

4.2.305.1 measure_value

The `measure_value` specifies the value of the physical quantity when expressed in the specified units.

4.2.305.2 qualifier

The `qualifier` specifies additional information in text format which describes the scope of the value. Aspects such as normalisation, correction, averaging, measured/predicted/estimated can be specified using the `qualifier` attribute.

4.2.306 Mechanical_component

A `Mechanical_component` is a type of `Mechanical_product_component` (see 4.2.316) and specifies the concept for all the mechanical components (see 3.10.18) that need to be defined.

4.2.307 Mechanical_connection

A `Mechanical_connection` is a type of `Mechanical_product_connection` (see 4.2.317) that specifies the connection between two mechanical components (see 3.10.18).

The data associated with a `Mechanical_connection` are the following:

- `connection_type`.

4.2.307.1 connection_type

The `connection_type` specifies the type of mechanical connection.

The value of the `connection_type` shall be one of the following:

- `shaft_bearing_interface`;
- `shaft_component_connection`;
- `shaft_shaft_connection`;
- `user_defined_mechanical_connection`.

4.2.307.1.1 `shaft_bearing_interface`: the descriptor which specifies that the mechanical connection is an interface between a shaft and a bearing.

4.2.307.1.2 `shaft_component_connection`: the descriptor which specifies that the mechanical connection is between a shaft and another component.

4.2.307.1.3 `shaft_shaft_connection`: the descriptor which specifies that the mechanical connection is between two shafts.

4.2.307.1.4 `user_defined_mechanical_connection`: the descriptor, set by the user, that specifies the type of mechanical connection if different from the other options.

4.2.308 `Mechanical_connection_general_characteristic`

A `Mechanical_connection_general_characteristic` is a type of `Product_connection_general_characteristic` (see 4.2.381) and specifies the mechanical connection's overall specifications and characteristics.

The data associated with a `Mechanical_connection_general_characteristic` are the following:

- `defined_for`;
- `power_transmission_data`.

4.2.308.1 `defined_for`

The `defined_for` specifies a set of one to many mechanical connections for which general characteristics are defined.

4.2.308.2 `power_transmission_data`

The `power_transmission_data` specifies the details of the mechanical power transmission data, such as torque and power, for the mechanical connection.

4.2.309 `Mechanical_connector`

A `Mechanical_connector` is a type of `Connector_component` (see 4.2.41) and specifies the concept for defining all the connectors that are classified as mechanical connector. Within this part of ISO 10303, each `Mechanical_connector` is either a `Shaft_end` (see 4.2.457), a `Shaft_journal` (see 4.2.458), or a `Bearing_element` (see 4.2.18).

4.2.310 Mechanical_equipment

A Mechanical_equipment is a type of Mechanical_product_equipment (see 4.2.319) and specifies the concept for defining all the mechanical equipment (see 3.10.59) that need to be defined. Within this part of ISO 10303, each Mechanical_equipment is either a Gear_box (see 4.2.202), a Shaft_coupling (see 4.2.454), a Mechanical_governor (see 4.2.311), a Silencer (see 4.2.480), a Damper (see 4.2.72) or a Clutch (see 4.2.33).

4.2.311 Mechanical_governor

A Mechanical_governor is a type of Mechanical_equipment (see 4.2.310) and specifies the concept for defining all the mechanical governors that need to be defined. A mechanical governor is a mechanical device that automatically regulates the speed of an engine or machine by varying the supply of fuel or steam according to the power demand.

4.2.312 Mechanical_machinery

A Mechanical_machinery is a type of Machinery (see 4.2.271) that specifies the high level concept for all types of mechanical machinery (see 3.10.60) which need to be defined. Within this part of ISO 10303, each Mechanical_machinery is either a Reciprocating_machinery (see 4.2.416) or a Rotating_machinery (see 4.2.423).

4.2.313 Mechanical_power_transmission_data

A Mechanical_power_transmission_data is a type of Mechanical_product_property (see 4.2.322) and specifies the concept for defining shaft power transmission data at design or during operation.

The data associated with a Mechanical_power_transmission_data are the following:

- power;
- power_point_qualifier;
- rotational_speed;
- torque.

4.2.313.1 power

The power specifies the power transmitted by the shaft.

4.2.313.2 power_point_qualifier

The power_point_qualifier identifies the location on the shaft for which the power transmission data are specified.

The value of the power_point_qualifier shall be one of the following:

- driven_end;
- driver_end;
- input;
- output;
- user_defined.

4.2.313.2.1 driven_end: the descriptor that specifies that the power transmission data applies to the driven end of the shaft

4.2.313.2.2 driver_end: the descriptor that specifies that the power transmission data applies to the driver end of the shaft.

4.2.313.2.3 input: the descriptor that specifies that the power transmission data applies to the input side of the shaft.

4.2.313.2.4 output: the descriptor that specifies that the power transmission data applies to the output side of the shaft.

4.2.313.2.5 user_defined: the descriptor, set by the user, that specifies the location on the shaft if different from the other options.

4.2.313.3 rotational_speed

The rotational_speed specifies the speed of rotation of the shaft.

4.2.313.4 torque

The torque specifies the torque transmitted by the shaft.

4.2.314 Mechanical_product

A Mechanical_product is a type of Item (see 4.2.253) that provides the high level concept for all the mechanical products (see 3.10.61) which need to be defined or described. Within this part of ISO 10303, each Mechanical_product is either a Mechanical_product_component (see 4.2.316), a Mechanical_product_equipment (see 4.2.319), a Mechanical_system (see 4.2.326) or a Plib_mechanical_product (see 4.2.363).

The data associated with a Mechanical_product are the following:

- product_function;
- ship_context.

4.2.314.1 product_function

The product_function specifies the functions, if any, of the mechanical product. There may be more than one product_function for a Mechanical_product.

4.2.314.2 ship_context

The ship_context specifies the context of the mechanical product in terms of its applicability or belonging to a ship. The ship_context need not be specified for a particular Mechanical_product.

4.2.315 Mechanical_product_fluid_select

A Mechanical_product_fluid_select specifies a fluid material as being either a gas material or liquid material.

The data associated with a Mechanical_product_fluid_select are the following:

— fluid_select.

The fluid_select specifies whether an ambient fluid is liquid or gas material.

4.2.316 Mechanical_product_component

A Mechanical_product_component is a type of Mechanical_product (see 4.2.314) that specifies the high level concept for all the components (see 3.10.18) which need to be defined or described. Within this part of ISO 10303 each Mechanical_product_component is either a Connecting_component (see 4.2.39), a Connector_component (see 4.2.41), a Control_component (see 4.2.43), a Generic_component (see 4.2.216), a Mechanical_component (see 4.2.306), a Piping_component (see 4.2.351) or a Rotating_component (see 4.2.421).

The data associated with a Mechanical_product_component are the following:

— part_of.

The part_of specifies the belonging of the component to either a mechanical system (see 3.10.62) or an equipment (see 3.10.40).

4.2.317 Mechanical_product_connection

A Mechanical_product_connection is a type of Product_connection (see 4.2.380) and a type of Mechanical_product_relationship (see 4.2.323) and specifies the high level concept for all the definitions which relate to connection (see 3.10.25) of a mechanical product to another item. Within this part of ISO 10303 each Mechanical_product_connection is either an Electrical_connection (see 4.2.120), a Mechanical_connection (see 4.2.307), a Piping_connection (see 4.2.354) or a Structural_connection (see 4.2.501).

The data associated with a Mechanical_product_connection are the following:

- connecting_components;
- connector_components;
- documentation.

4.2.317.1 connecting_components

The connecting_components specifies all the connecting components (see 3.10.24) required in order to realise a connection. There may be more than one connecting_components for a Mechanical_product_connection.

4.2.317.2 connector_components

The connector_components specifies all the connectors (see 3.10.26) for this connection. There may be more than one connector_component for a Mechanical_product_connection.

4.2.317.3 documentation

The documentation specifies all the operational and functional characteristics for the connection as well as manuals describing how to realise the connection. There may be more than one documentation for a Mechanical_product_connection.

4.2.318 Mechanical_product_drawing

A Mechanical_product_drawing is a type of Mechanical_product_representation (see 4.2.324) that specifies the geometric representation of mechanical product in the form of one to many CAD drawings together with identification of the drawing configuration. Within this part of ISO 10303 each Mechanical_product_drawing is either a Diesel_engine_drawing (see 4.2.92), a Gas_turbine_engine_drawing (see 4.2.189), a Gear_box_drawing (see 4.2.206), a Heat_exchanger_drawing (see 4.2.235), a Pump_drawing (see 4.2.400), a Crane_drawing (see 4.2.55), a Screw_propeller_drawing (see 4.2.435) or a Shaft_drawing (see 4.2.456).

The data associated with a Mechanical_product_drawing are the following:

- defined_for;
- drawing;
- external_reference_drawing.

4.2.318.1 defined_for

The defined_for specifies a set of one to many mechanical products for which drawing is defined.

4.2.318.2 drawing

The drawing attribute specifies the detailed representation of mechanical product in the form of a CAD drawing. This is supported through use of a Geometric_representation_item (see 4.2.226) as defined in ISO 10303-42. There may be more than one drawing for a Mechanical_product_drawing.

4.2.318.3 external_reference_drawing

The external_reference_drawing specifies the product drawing by specifying a set of external drawings. There may be more than one external_reference_drawing for a Mechanical_product_drawing.

4.2.319 Mechanical_product_equipment

A Mechanical_product_equipment is a type of Mechanical_product (see 4.2.314) and specifies the high level concept for all the equipment (see 3.10.40) that needs to be defined. Within this part of ISO 10303 each Mechanical_product_equipment is either a Machinery (see 4.2.271), a Control_equipment (see 4.2.44), an Electrical_equipment (see 4.2.123), a Generic_equipment (see 4.2.219), a Lifting_equipment (see 4.2.261), a Mechanical_equipment (see 4.2.310), a Piping_equipment (see 4.2.357) or a Process_equipment (see 4.2.373).

The data associated with a Mechanical_product_equipment are the following:

- alternative_names.

The alternative_names specifies a set, if any, of alternative names that can be used to identify the equipment. There may be more than one alternative_names for a Mechanical_product_equipment.

4.2.320 Mechanical_product_external_resources_requirement

A Mechanical_product_external_resources_requirement is a type of Definition (see 4.2.77) and specifies the resources and utilities needed by a mechanical product, to enable it to perform its required function.

The data associated with a Mechanical_product_external_resources_requirement are the following:

- defined_for;
- electrical_requirement;
- gas_material_requirement;
- liquid_material_requirement;
- solid_material_requirement;
- spare_parts_requirement.

4.2.320.1 defined_for

The defined_for specifies a set of one to many mechanical products for which the required external utility resources are defined.

4.2.320.2 electrical_requirement

The electrical_requirement specifies a set of Electrical_requirement (see 4.2.125), representing the level and details of electricity that is needed by the mechanical product, and has to be met by an external resource. There may be more than one electrical_requirement for a Mechanical_product_external_resources_requirement.

4.2.320.3 gas_material_requirement

The gas_material_requirement specifies a set of Gas_material_requirement (see 4.2.182), representing the level and details of gases that are needed by the mechanical product, and have to be met by an external resource. There may be more than one gas_material_requirement for a Mechanical_product_external_resources_requirement.

4.2.320.4 liquid_material_requirement

The liquid_material_requirement specifies a set of Liquid_material_requirement (see 4.2.266), representing the level and details of liquids that are needed by the mechanical product, and have be met by an external resource. There may be more than one liquid_material_requirement for a Mechanical_product_external_resources_requirement.

4.2.320.5 solid_material_requirement

The solid_material_requirement specifies a set of Solid_material_requirement (see 4.2.485), representing the level and details of solid consumable materials that are needed by the mechanical product, and have be met by an external resource. There may be more than one solid_material_requirement for a Mechanical_product_external_resources_requirement.

4.2.320.6 spare_parts_requirement

The spare_parts_requirement specifies a set of Spare_parts_requirement (see 4.2.489), representing the level and details of spare parts that are needed by the mechanical product, and have be met by procurement. There may be more than one spare_parts_requirement for a Mechanical_product_external_resources_requirement.

4.2.321 Mechanical_product_general_characteristic

A `Mechanical_product_general_characteristic` is a type of `Definition` (see 4.2.77) and specifies the high level concept for all the definitions which are attributable to the general characteristics (see 3.10.49) of the mechanical product. Within this part of ISO 10303 each `Mechanical_product_general_characteristic` is either an `Equipment_general_characteristic` (see 4.2.134), or a `Mechanical_system_general_characteristic` (see 4.2.328).

The data associated with a `Mechanical_product_general_characteristic` are the following:

- `defined_for`.

The `defined_for` attribute specifies a set of one to many mechanical products for which the general characteristics are defined.

4.2.322 Mechanical_product_property

A `Mechanical_product_property` specifies the concept for defining all the data relating to properties of a mechanical product.

4.2.323 Mechanical_product_relationship

A `Mechanical_product_relationship` is a type of `Item_relationship` (see 4.2.254) that defines the relationship and association between two mechanical products.

The data associated with a `Mechanical_product_relationship` are the following:

- `item_one`;
- `item_two`.

4.2.323.1 item_one

The `item_one` specifies the first mechanical product that takes part in the relationship.

4.2.323.2 item_two

The `item_two` specifies the second mechanical product that takes part in the relationship.

4.2.324 Mechanical_product_representation

A `Mechanical_product_representation` is a type of `Geometric_definition` (see 4.2.225) and specifies the concept for detailed geometry of a mechanical product. Within this part of ISO 10303 each `Mechanical_product_representation` is either a `Mechanical_product_shape_representation` (see 4.2.325) or a `Mechanical_product_drawing` (see 4.2.318).

4.2.325 Mechanical_product_shape_representation

A `Mechanical_product_shape_representation` is a type of `Mechanical_product_representation` (see 4.2.324) and specifies the external shape of a mechanical product.

The data associated with a `Mechanical_product_shape_representation` are the following:

- `defined_for`;
- `external_reference_shape_representation`;

- plib_shape_representation;
- shape_solid.

4.2.325.1 defined_for

The `defined_for` specifies a set of one to many mechanical products for which shape is defined.

4.2.325.2 external_reference_shape_representation

The `external_reference_shape_representation` specifies a set of, if any, externally defined shapes for the mechanical product using the external referencing mechanism. There may be more than one `external_reference_shape_representation` for a `Mechanical_product_shape_representation`.

4.2.325.3 plib_shape_representation

The `plib_shape_representation` specifies a set of, if any, externally defined shapes for the mechanical product via reference to a Parts Library (ISO 13548) compliant external library. There may be more than one `plib_shape_representation` for a particular `Mechanical_product_shape_representation`.

4.2.325.4 shape_solid

The `shape_solid` specifies the external shape representation of the mechanical product in the form of a solid model (see 3.10.91). The shape representation is supported by `Solid_model` (see 4.2.486). There may be more than one `shape_solid` for a `Mechanical_product_shape_representation`.

4.2.326 Mechanical_system

A `Mechanical_system` is a type of `Mechanical_product` (see 4.2.314) that provides the high level concept for all the mechanical systems (see 3.10.62) that needs to be defined or described. Within this part of ISO 10303 each `Mechanical_system` is either an `Azimuth_thruster` (see 4.2.15), an `Alarm_system` (see 4.2.4), a `Control_and_monitoring_system` (see 4.2.37), an `Electrical_system` (see 4.2.126), a `Machinery_piping_system` (see 4.2.277), a `Manoeuvring_system` (see 4.2.293), a `Mechanical_transmission_system` (see 4.2.329), a `Propulsion_system` (see 4.2.393), a `Pump_jet_propulsor` (see 4.2.403), a `Data_logging_system` (see 4.2.73), a `Steam_generation_system` (see 4.2.494), or a `Water_jet_propulsor` (see 4.2.553).

4.2.327 Mechanical_system_design_characteristic

A `Mechanical_system_design_characteristic` is a type of `Design_characteristic` (see 4.2.83) and specifies the high level concept for associating design characteristics to all items that are classified as mechanical systems.

4.2.328 Mechanical_system_general_characteristic

A `Mechanical_system_general_characteristic` is a type of `Mechanical_product_general_characteristic` (see 4.2.321) and specifies the high level concept for associating design characteristics to all items that are classified as mechanical systems.

4.2.329 Mechanical_transmission_system

A `Mechanical_transmission_system` is a type of `Mechanical_system` (see 4.2.326) that specifies and represents all types of mechanical transmission systems which need to be defined. A transmission

system is a system by which motive power from prime mover is made available at load (for example, shafting system connecting main engine to propeller, or shafting system connecting auxiliary engine to generator).

The data associated with a Mechanical_transmission_system are the following:

- type_of.

The type_of attribute specifies, as text, the type of mechanical transmission system.

4.2.330 Mechanical_transmission_system_design_characteristic

A Mechanical_transmission_system_design_characteristic is a type of Mechanical_system_design_characteristic (see 4.2.327) and specifies the functional design data for a mechanical transmission system.

The data associated with a Mechanical_transmission_system_design_characteristic are the following:

- defined_for;
- maximum_rotational_speed;
- maximum_transmittable_torque;
- overall_efficiency_at_design.

4.2.330.1 defined_for

The defined_for specifies a set of one to many mechanical transmission system for which design characteristics are defined.

4.2.330.2 maximum_rotational_speed

The maximum_rotational_speed specifies the maximum speed of rotation of the transmission system shaft, according to design.

4.2.330.3 maximum_transmittable_torque

The maximum_transmittable_torque specifies the maximum torque that the shaft is designed to transmit.

4.2.330.4 overall_efficiency_at_design

The overall_efficiency_at_design specifies the mechanical efficiency of the transmission system according to design.

4.2.331 Mechanical_transmission_system_general_characteristics

A Mechanical_transmission_system_general_characteristics is a type of Mechanical_system_general_characteristic (see 4.2.328) and specifies the overall specifications and characteristics of a mechanical transmission system.

The data associated with a Mechanical_transmission_system_general_characteristics are the following:

- defined_for;
- overall_gear_ratio.

4.2.331.1 defined_for

The `defined_for` specifies a set of one to mechanical transmission systems for which general characteristics are defined.

4.2.331.2 overall_gear_ratio

The `overall_gear_ratio` specifies the gear ratio based on the ratio of the inlet and output speeds of the transmission system shafts.

4.2.332 Model_and_nameplate_data

A `Model_and_nameplate_data` specifies the concept for defining the data relating to mechanical product identification as used on the market.

The data associated with a `Model_and_nameplate_data` are the following:

- `model_number`;
- `model_type`;
- `nameplate_data`.

4.2.332.1 model_number

The `model_number` specifies, as text, the model identification assigned to a mechanical product.

4.2.332.2 model_type

The `model_type` specifies, as text, the model type identification assigned to a mechanical product.

4.2.332.3 nameplate_data

The `nameplate_data` specify, as text, the identification information contained in the data-plate attached to a mechanical product.

4.2.333 Motor_starter

A `Motor_starter` is a type of `Electrical_equipment` (see 4.2.123) and specifies the concept for defining all the motor starters that need to be defined. A motor starter is an equipment used for driving an engine from standstill, in order to initiate the engine combustion process and attain its self-sustained rotation.

4.2.334 Molecular_weight

A `Molecular_weight` is a type of `Measure_with_unit` (see 4.2.305) where the physical quantity is the molecular weight.

The data associated with a `Molecular_weight` are the following:

- `molecular_weight_unit`.

The `molecular_weight_unit` specifies all the engineering units which can be used for molecular weight.

4.2.335 Non_periodic_task_interval

A Non_periodic_task_interval specifies all the types of a task interval that is not periodic based.

The data associated with a Non_periodic_task_interval are the following:

- description;
- non_periodic_interval_type.

4.2.335.1 description

The description attribute specifies, as text, additional information on task interval for tasks that are not going to be performed at any prescribed time-based or counter-based intervals.

4.2.335.2 non_periodic_interval_type

The non_periodic_interval_type describes the type of the task interval if it is not counter-based or time-based.

The value of interval_type shall be one of the following:

- condition_based;
- corrective;
- user_defined.

4.2.335.2.1 condition_based: the descriptor that specifies that the task should be done according to the equipment condition as verified by condition monitoring.

4.2.335.2.2 corrective: the descriptor that specifies that the task should be done whenever a failure is detected.

4.2.335.2.3 user_defined: the descriptor, set by the user, that specifies the criterion for performing the task if different from the other options.

4.2.336 Number_value

The Number_value specifies that the property value is of type number.

The data associated with a Number_value are the following:

- the_value.

The the_value specifies the actual value of the property in the form of a number (integer or real number).

4.2.337 Nut

A Nut is a type of Connecting_component (see 4.2.39) and specifies the concept for all the mechanical nuts that need to be defined. A nut, in conjunction with a Bolt (see 4.2.21), is used for fixing mechanical products.

4.2.338 Oil_mist_detection_system

An Oil_mist_detection_system is a type of Condition_monitoring_system (see 4.2.37) and specifies the concept for defining all the oil mist detection systems that need to be defined. An oil mist detection system is used in the diesel engines to prevent crankcase explosions.

4.2.339 Operation_anomaly

An Operation_anomaly is a type of Product_anomaly (see 4.2.376) and specifies the concept for defining all the data relating to anomalies that are due to the mis-operation of a mechanical product.

The data associated with an Operation_anomaly are the following:

- operation_anomaly_type.

The operation_anomaly_type specifies, as text, the type of an anomaly that occurred during mis-operation.

4.2.340 Operation_task

An Operation_task is a type of Task (see 4.2.511) that specifies the concept for representation of data that are attributable to the activities relating to the normal operational aspects of a mechanical product.

The data associated with an Operation_task are the following:

- type_of_task.

The type_of_task specifies the type of operation task in a text format.

4.2.341 Operational_characteristic

An Operational_characteristic is a type of Functional_characteristic (see 4.2.179) that specifies the high level concept for all the definitions (see 3.10.32) which are attributable to operational aspects of a mechanical product.

The data associated with an Operational_characteristic are the following:

- date_and_time;
- defined_for.

4.2.341.1 date_and_time

The date_and_time specifies the date and time when operational data were acquired.

4.2.341.2 defined_for

The defined_for attribute specifies a set of one to many mechanical products for which operational data are defined.

4.2.342 Order_definition

An Order_definition is a type of Procurement_definition (see 4.2.375) and specifies the data associated with an order of a mechanical product.

The data associated with an Order_definition are the following:

- consumption_level;
- defined_for;
- order_unit;
- suppliers;
- unit_per_order_unit.

4.2.342.1 consumption_level

The consumption_level specifies, as text, the level of consumption for the selected mechanical product. The consumption_level need not be specified for a particular Order_definition.

4.2.342.2 defined_for

The defined_for specifies a set of one to many mechanical products for which an order definition is specified.

4.2.342.3 order_unit

The order_unit specifies, as text, the unit (box, container, barrel and so on) used to quantify an order of the selected mechanical product. The order_unit need not be specified for a particular Order_definition.

4.2.342.4 suppliers

The suppliers attribute specifies zero to many Person_and_organization (see 4.2.347) that are responsible for supplying the ordered mechanical products. The suppliers need not be specified for a particular Order_definition.

4.2.342.5 unit_per_order_unit

The unit_per_order_unit specifies, as text, the quantity of mechanical products per an order_unit (see 4.2.342.3). The unit_per_order_unit need not be specified for a particular Order_definition.

4.2.343 Organization

An Organization specifies the details of the referenced organisation. It is used as defined in ISO 10303-41.

4.2.344 Organizational_project

An Organizational_project specifies the details of the referenced project. It is used as defined in ISO 10303-41.

4.2.345 Overall_dimension

An Overall_dimension is a type of Geometric_definition (see 4.2.225) that specifies the overall length, breadth and height of a mechanical product. Within this part of ISO 10303 each Overall_dimension is either a Crane_overall_dimension (see 4.2.61), a Diesel_engine_overall_dimension (see 4.2.99), a Gas_turbine_engine_overall_dimension (see 4.2.195), a Gear_box_overall_dimension (see 4.2.211), a Generic_equipment_dimensional_characteristic (see 4.2.220), a Heat_exchanger_overall_dimension (see 4.2.241), a Pump_overall_dimension (see 4.2.407), a Screw_propeller_overall_dimension (see 4.2.441), a Shaft_overall_dimension (see 4.2.464) or a Ship_overall_dimension (see 4.2.474).

The data associated with an Overall_dimension are the following:

- defined_for;
- overall_breadth;
- overall_height;
- overall_length.

4.2.345.1 defined_for

The defined_for specifies a set of one to many mechanical products for which dimensional data are defined.

4.2.345.2 overall_breadth

The overall_breadth specifies the overall breadth of the mechanical product.

4.2.345.3 overall_height

The overall_height specifies the overall height of the mechanical product.

4.2.345.4 overall_length

The overall_length specifies the overall length of the mechanical product.

4.2.346 Person

A Person specifies the details of a person which needs to be identified. It is used as defined in ISO 10303-41.

4.2.347 Person_and_organization

A Person_and_organization specifies the details of a person and his/her affiliated organisation. It is used as defined in ISO 10303-41.

4.2.348 Physical_definition

A Physical_definition is a type of Definition (see 4.2.77) and specifies the high level concept for all the definitions attributable to the physical (see 3.10.68) aspects of a mechanical product. Within this part of ISO 10303 each Physical_definition is either a Geometric_definition (see 4.2.225), a Mass_weight_inertia (see 4.2.297), or a Product_material (see 4.2.386).

4.2.349 Pin

A Pin is a type of Connecting_component (see 4.2.39) and specifies the concept for all the mechanical pins that need to be defined. Pins are cylindrical pieces of metal that are used in linking or fastening two parts together.

4.2.350 Pipe

A Pipe is a type of Piping_component (see 4.2.351) that specifies the data representation concept for all the pipes that need to be defined.

The data associated with a Pipe are the following:

- pipe_type.

The pipe_type specifies, as text, the type of pipe.

4.2.351 Piping_component

A Piping_component is a type of Mechanical_product_component (see 4.2.316) that specifies the high level concept for all the piping components which need to be defined.

4.2.352 Piping_component_design_characteristic

A Piping_component_design_characteristic specifies the functional design data for a piping component.

The data associated with a Piping_component_design_characteristic are the following:

- defined_for;
- design_points.

4.2.352.1 defined_for

The defined_for specifies a set of one to many piping components for which design characteristics are defined.

4.2.352.2 design_points

The design_points specifies a set of Fluid_flow_data (see 4.2.168), representing the piping component functional design data at a number of design conditions. There may be more than one design_points for a Piping_component_design_characteristic.

4.2.353 Piping_component_operational_characteristic

A Piping_component_operational_characteristic specifies the piping component-related operational data.

The data associated with a Piping_component_operational_characteristic are the following:

- defined_for;
- operating_points.

4.2.353.1 defined_for

The `defined_for` specifies a set of one to many piping components for which operational characteristics are defined.

4.2.353.2 operating_points

The `operating_points` specify a set of `Fluid_flow_data` (see 4.2.168), representing the piping component functional data at a number of operating conditions during operation. There may be more than one `operating_points` for a `Piping_component_design_characteristic`.

4.2.354 Piping_connection

A `Piping_connection` is a type of `Mechanical_product_connection` (see 4.2.317) that specifies the connection between a mechanical connector (see 3.10.58) and a piping connector (see 3.10.69) or between two piping connectors.

The data associated with a `Piping_connection` are the following:

- `connection_type`.

4.2.354.1 connection_type

The `connection_type` specifies the type of piping connection.

The value of the `connection_type` shall be one of the following:

- `butt`;
- `flanged`;
- `flared`;
- `screwed`;
- `socketed`;
- `union`;
- `user_defined_piping_connection_type`;
- `welded`.

4.2.354.1.1 butt: the descriptor which specifies that the piping connection is of type butt welded.

4.2.354.1.2 flanged: the descriptor which specifies that the piping connection is of type flanged.

4.2.354.1.3 flared: the descriptor which specifies that the piping connection is of type flared.

4.2.354.1.4 screwed: the descriptor which specifies that the piping connection is of type screwed.

4.2.354.1.5 socketed: the descriptor which specifies that the piping connection is of type socketed.

4.2.354.1.6 union: the descriptor which specifies that the piping connection is of type union.

4.2.354.1.7 user_defined_piping_connection_type: the descriptor, set by the user, which specifies the type of piping connection if different from the other options.

4.2.354.1.8 welded: the descriptor which specifies the piping connection is of type welded.

4.2.355 Piping_connection_general_characteristic

A Piping_connection_general_characteristic is a type of Product_connection_general_characteristic (see 4.2.381) and specifies the piping connection's overall specifications and characteristics.

The data associated with a Piping_connection_general_characteristic are the following:

- defined_for;
- fluid_flow_data.

4.2.355.1 defined_for

The defined_for specifies a set of one to many mechanical connections for which general characteristics are defined.

4.2.355.2 fluid_flow_data

The fluid_flow_data specifies the details of the fluid material requirements, such as flowrate and pressure, for the piping connection.

4.2.356 Piping_connector

A Piping_connector is a type of Connector_component (see 4.2.41) and specifies the concept for defining all the connectors that are classified as piping connector.

4.2.357 Piping_equipment

A Piping_equipment is a type of Mechanical_product_equipment (see 4.2.319) and specifies the concept for defining all the piping equipment (see 3.10.70) that need to be defined. Within this part of ISO 10303, each Piping_equipment is either a Pressure_vessel (see 4.2.368), a Tank (see 4.2.510), or a Valve (see 4.2.545).

4.2.358 Piping_item_end

A Piping_item_end is a type of Piping_connector (see 4.2.356) and specifies the concept for all the piping item ends that need to be defined. Within this part of ISO 10303, a piping item end is the end part of the pipe that is used for connecting the pipe to another device.

The data associated with a Piping_item_end are the following:

- piping_item_end_type.

4.2.358.1 piping_item_end_type

The piping_item_end_type specifies the type of the piping item end.

The value of piping_item_end_type shall be one of the following:

- flanged_end;
- flared_end;
- socketed_end;
- welded_end.

4.2.358.1.1 flanged_end: the descriptor that specifies the connection at the pipe end with another mechanical product is achieved with a flange.

4.2.358.1.2 flared_end: the descriptor that specifies the connection at the pipe end with another mechanical product is achieved with flaring.

4.2.358.1.3 socketed_end: the descriptor that specifies the connection at the pipe end with another mechanical product is achieved with a socket.

4.2.358.1.4 welded_end: the descriptor that specifies the connection at the pipe end with another mechanical product is achieved with a weld.

4.2.359 Piston

A Piston is a type of Mechanical_component (see 4.2.306) and specifies the concept for all the pistons that need to be defined. A piston is a circular section component that acts as the working part of a reciprocating machinery such as diesel engines and reciprocating pumps. The piston moves back and forth in the cylinder under the action of machinery working fluid and crankshaft motion.

4.2.360 Plane_angle

A Plane_angle is a type of Measure_with_unit (see 4.2.305) where the physical quantity is a plane angle as defined in ISO 31 (clause 2).

The data associated with a Plane_angle are the following:

- plane_angle_unit.

The plane_angle_unit specifies all the units in which plane angles are measured.

4.2.361 Plib_defined_shape_representation

A Plib_defined_shape_representation specifies a mechanical product shape representation as defined in an ISO 13584 compliant data library.

The data associated with a Plib_defined_shape_representation are the following:

- axis2_placement;
- library_element.

4.2.361.1 axis2_placement

The axis2_placement specifies the shape representation according to ISO 13584.

4.2.361.2 library_element

The library_element specifies a Library_element_reference (see 4.2.259) which contains the complete set of information for referencing an instance of a mechanical product in an ISO 13584 compliant data library

4.2.362 Plib_definition

A Plib_definition is a type of Definition (see 4.2.77) and specifies the concept for grouping of the properties that are defined in an ISO 13584 compliant data dictionary for use within this part of ISO 10303.

The data associated with a Plib_definition are the following:

- defined_for;
- grouped_properties;
- property_and_property_value.

4.2.362.1 defined_for

The defined_for specifies a set of one to many mechanical products for which properties from the ISO 13584 compliant data dictionary are defined.

4.2.362.2 grouped_properties

The grouped_properties specify a set of Grouped_property (see 4.2.228), representing whole sets of, if any, properties according to ISO 13584. There may be more than one grouped_properties for a Plib_definition.

4.2.362.3 property_and_property_value

The property_and_property_value specifies a set of Library_property_and_property_value (see 4.2.260), defining the type of property and its value according to ISO 13584. There may be more than one property_and_property_value for a Plib_definition.

4.2.363 Plib_mechanical_product

A Plib_mechanical_product is a type of Mechanical_product (see 4.2.314) and specifies a mechanical product as defined in an ISO 13584 compliant data dictionary.

The data associated with a Plib_mechanical_product are the following:

- mechanical_product.

The mechanical_product specifies the type of mechanical product as defined in an ISO 13584 compliant data dictionary by reference to a Library_class_identifier (see 4.2.258).

4.2.364 Plug

A Plug is a type of Electrical_connector (see 4.2.121) and specifies the concept for all the electrical plugs that need to be defined. An electric plug is a male connector that is inserted into an electric socket.

4.2.365 Power

A Power is a type of Measure_with_unit (see 4.2.305) where the physical quantity is power (energy per time).

The data associated with a Power are the following:

- power_unit.

The power_unit specifies all the units in which the physical quantity of power is measured.

4.2.366 Pressure

A Pressure is a type of Measure_with_unit (see 4.2.305) where the physical quantity is pressure (force per area).

The data associated with a Pressure are the following:

- pressure_unit.

The pressure_unit specifies all the units in which the physical quantity of pressure is measured.

4.2.367 Pressure_sensor

A Pressure_sensor is a type of Sensor (see 4.2.448) and specifies the concept for defining all the sensors that are used for measuring fluid pressure.

4.2.368 Pressure_vessel

A Pressure_vessel is a type of Piping_equipment (see 4.2.357) and specifies the concept for defining all the pressure vessels that need to be defined. A pressure vessel is a container for fluids, often of steel or aluminium, that can withstand pressures above or below atmospheric pressures.

4.2.369 Price

A Price specifies the price value of a mechanical product and the name of the corresponding currency.

The data associated with a Price are the following:

- currency_type;
- price_value.

4.2.369.1 currency_type

The currency_type specifies the type of currency used in the transaction.

The value for the currency_type shall be one of the following:

- dollar;
- euro;
- pound;
- user_defined_currency_type.

4.2.369.1.1 dollar: the descriptor that specifies that the currency used is dollar.

4.2.369.1.2 euro: the descriptor that specifies that the currency used is European currency Euro.

4.2.369.1.3 pound: the descriptor that specifies that the currency used is Pound Sterling.

4.2.369.1.4 user_defined_currency_type: the descriptor, set by the user, that specifies the currency type if different from the other options.

4.2.369.2 price_value

The price_value specifies the price of the procured mechanical product.

4.2.370 Price_and_date

A Price_and_date specifies the data concerned with the pricing of a mechanical product in a procurement process.

The data associated with a Price_and_date are the following:

- date;
- price.

4.2.370.1 date

The date specifies the calendar date at which the price is quoted. The date need not be specified for a particular Delivery.

4.2.370.2 price

The price specifies the Price (see 4.2.369) of the mechanical product.

4.2.371 Price_definition

A Price_definition is a type of Procurement_definition (see 4.2.375) and specifies the financial data associated with the procurement of a mechanical product.

The data associated with a Price_definition are the following:

- current_price;
- defined_for;
- last_price.

4.2.371.1 current_price

The current_price specifies the latest price of the mechanical product for procurement. The current_price needs not be specified for a particular Price_definition.

4.2.371.2 defined_for

The defined_for specifies a set of one to many mechanical products for which the price definition is specified.

4.2.371.3 last_price

The last_price specifies the price data for a mechanical product for one of previous procurements. The last_price need not be specified for a particular Price_definition.

4.2.372 Principal_characteristics

The Principal_characteristics is a type of Ship_general_characteristic (see 4.2.472) and specifies the main shape parameters of the hull moulded form. Principal_characteristics also includes data that is required in subsequent iterations of the hull development process when one is considering hydrostatics.

The data associated with a Principal_characteristics are the following:

- block_coefficient;
- design_deadweight;
- design_draught;
- gross_tonnage;
- length_between_perpendiculars;
- mass_measure;
- max_draught_at_AP;
- max_draught_at_FP;
- min_draught_at_AP;
- min_draught_at_FP;
- moulded_breadth;
- moulded_depth.

4.2.372.1 block_coefficient

The block_coefficient specifies the ratio of the moulded displacement volume to the volume of a block that has its length equal to the length_between_perpendiculars, its breadth equal to the maximum immersed moulded_breadth and its depth equal to the design_draught. The block_coefficient should be defined only for mono hull ships.

4.2.372.2 defined_for

The defined_for specifies a set of one to many ships for which principal characteristics are defined.

4.2.372.3 design_deadweight

The design_deadweight specifies the weight of the ship representing the weight of cargo, bunker fuel, water, passengers, crew and consumables which a ship can carry when loaded to her summer load line.

4.2.372.4 design_draught

The design_draught specifies the optimal draught to which the ship has been designed to operate.

4.2.372.5 gross_tonnage

The gross_tonnage specifies the total weight of the ship while fully loaded.

4.2.372.6 length_between_perpendiculars

The `length_between_perpendiculars` specifies the length measured from the after perpendicular to the forward perpendicular of the ship.

4.2.372.7 max_draught_at_AP

The `max_draught_at_AP` specifies the maximum possible draught at the Aft Perpendicular during the operation of the ship. The `max_draught_at_AP` is used for at hull cross section approval for the ice class notation.

4.2.372.8 max_draught_at_FP

The `max_draught_at_FP` specifies the maximum possible draught at the Forward Perpendicular during the operation of the ship. The `max_draught_at_FP` is used at hull cross section approval for the ice class notation.

4.2.372.9 min_draught_at_AP

The `min_draught_at_AP` specifies the minimum possible draught at the Aft Perpendicular during the operation of the ship. The `min_draught_at_AP` is used at hull cross section approval for the ice class notation.

4.2.372.10 min_draught_at_FP

The `min_draught_at_FP` specifies the minimum possible draught at the Forward Perpendicular during the operation of the ship. The `min_draught_at_FP` is used at hull cross section approval for the ice class notation.

4.2.372.11 moulded_breadth

The `moulded_breadth` specifies the maximum breadth of the ship amidships and at the `design_draught`.

4.2.372.12 moulded_depth

The `moulded_depth` specifies the vertical distance above the baseline to the uppermost deck where the deck joins the side of the ship measured amidships.

4.2.373 Process_equipment

A `Process_equipment` is a type of `Mechanical_product_equipment` (see 4.2.319) and specifies the concept for all the ship's process equipment (see 3.10.75) which need to be defined. Within this part of ISO 10303 each `Process_equipment` is either a `Condenser` (see 4.2.36), a `De-aerator` (see 4.2.74), a `De-oiler` (see 4.2.75), an `Ejector` (see 4.2.109), a `Filter` (see 4.2.162), or a `Heat_exchanger` (see 4.2.230).

4.2.374 Process_machinery

A `Process_machinery` is a type of `Machinery` (see 4.2.271) and specifies the concept for all the process machinery that needs to be defined. Within this part of ISO 10303 each `Process_machinery` is either an `Agitator` (see 4.2.3), a `Centrifuge` (see 4.2.28), a `Separator` (see 4.2.449), a `Purifier` (see 4.2.412), a `Homogeniser` (see 4.2.246), or a `Clarifier` (see 4.2.30).

4.2.375 Procurement_definition

A Procurement_definition is a type of Definition (see 4.2.77) and specifies the high level concept for all the procurement information that needs to be defined for a mechanical product. Within this part of ISO 10303, a Procurement_definition is either a Price_definition (see 4.2.371), a Stock_definition (see 4.2.498), an Order_definition (see 4.2.342) or a Delivery_definition (see 4.2.80).

The data associated with a Procurement_definition are the following:

— defined_for.

The defined_for specifies a set of one to many mechanical products for which procurement definition is defined.

4.2.376 Product_anomaly

A Product_anomaly is a type of Item (see 4.2.253) that specifies the high level concept for representing all types of anomalies (see 3.10.6) that need to be defined. Within this part of ISO 10303 each Product_anomaly is either a Design_anomaly (see 4.2.82), a Failure (see 4.2.149), a Fault (see 4.2.156), or an Operation_anomaly (see 4.2.339).

The data associated with a Product_anomaly are the following:

— related_mechanical_products.

The related_mechanical_products specifies a set of mechanical products which relate to an anomaly. There may be more than one related_mechanical_product for a particular Product_anomaly.

4.2.377 Product_anomaly_definition

A Product_anomaly_definition is a type of Definition (see 4.2.77) and specifies the concept for defining all the data relating to mechanical product functional anomalies, such as faults and failures. Within this part of ISO 10303, each Product_anomaly_definition is either an Anomaly_time_and_date (see 4.2.12), an Anomaly_effect (see 4.2.11), an Anomaly_criticality (see 4.2.10), an Anomaly_configuration_data (see 4.2.9), or an Anomaly_cause(see 4.2.8).

4.2.378 Product_assemblage

A Product_assemblage is a type of Product_structure_definition (see 4.2.391) that specifies the information which defines the way the mechanical product is assembled.

The data associated with a Product_assembly are the following:

— assembled_items_relationships;
— defined_for;
— method_of_assembly.

4.2.378.1 assembled_items_relationships

The `assembled_items_relationships` specifies all the relationships between the constituent items of the mechanical product. There may be more than one `assembled_items_relationships` for a `Product_assemblage`.

4.2.378.2 defined_for

The `defined_for` specifies a set of one to many mechanical products for which assembly data are defined.

4.2.378.3 method_of_assembly

The `method_of_assembly` specifies the information which describes the method of assembly and disassembly in the form of a set of documents, if any. There may be more than one `method_of_assembly` for a `Product_assemblage`.

4.2.379 Product_composition

A `Product_composition` is a type of `Product_structure_definition` (see 4.2.391) that specifies the high level concept for all the definitions which relate to the composition (see 3.10.19) of a mechanical product. Within this part of ISO 10303 each `Product_composition` is either a `Crane_composition` (see 4.2.51), a `Diesel_engine_composition` (see 4.2.87), a `Gear_box_composition` (see 4.2.203), a `Heat_exchanger_composition` (see 4.2.231), a `Machinery_composition` (see 4.2.272), a `Shaft_composition` (see 4.2.452), or a `System_composition` (see 4.2.509).

The data associated with a `Product_composition` are the following:

- `composed_of`;
- `defined_for`.

4.2.379.1 composed_of

The `composed_of` specifies a set of mechanical products which are members of composition (see 3.10.19) for this mechanical product. There may be more than one `composed_of` for a `Product_composition`.

4.2.379.2 defined_for

The `defined_for` specifies a set of one to many mechanical products for which product composition is defined.

4.2.380 Product_connection

A `Product_connection` specifies the generic connection type for joining two mechanical products.

The data associated with a `Product_connection` are the following:

- `connection_type`;

The `connection_type` specifies, as text, the type of connection between two mechanical products.

4.2.381 Product_connection_general_characteristic

A Product_connection_general_characteristic is a type of Definition (see 4.2.77) and specifies all the information needed for defining general properties of a product connection. Within this part of ISO 10303, each Product_connection_general_characteristic is either an Electrical_connection_general_characteristic (see 4.2.119), a Mechanical_connection_general_characteristic (see 4.2.308), a Structural_connection_general_characteristic (see 4.2.502), or a Piping_connection_general_characteristic (see 4.2.355).

The data associated with a Product_connection_general_characteristic are the following:

- defined_for.

The defined_for specifies a set of one to many mechanical product connections for which general characteristics are defined.

4.2.382 Product_connectivity

A Product_connectivity is a type of Product_structure_definition (see 4.2.391) that specifies the concept for all the definitions which relate to product connectivity of a mechanical product. Within this part of ISO 10303 each Product_connectivity is either a Crane_connectivity (see 4.2.52), a Diesel_engine_connectivity (see 4.2.88), a Gas_turbine_engine_connectivity (see 4.2.186), a Gear_box_connectivity (see 4.2.204), a Heat_exchanger_connectivity (see 4.2.232), a Pump_connectivity (see 4.2.397), a Screw_propeller_connectivity (see 4.2.432), or a Shaft_connectivity (see 4.2.453).

The data associated with a Product_connectivity are the following:

- defined_for;
- product_connections;
- product_connectivity_specifications.

4.2.382.1 defined_for

The defined_for specifies a set of one to many mechanical products for which connectivity data are defined.

4.2.382.2 product_connections

The product_connections specifies a set of, if any, all types of connection for the product by referencing the Product_connection (see 4.2.380) application object. There may be more than one product_connections for a particular Product_connectivity.

4.2.382.3 product_connectivity_specifications

The product_connectivity_specifications specifies a set of, if any, documents that define the overall specification of the product connections. There may be more than one product_connectivity_specifications for a Product_connectivity.

4.2.383 Product_context

A Product_context is a type of Configuration_definition (see 4.2.38) and specifies the data which define the context within which a mechanical product is used or considered. Within this part of ISO 10303 each Product_context is either a Crane_context (see 4.2.53), a Diesel_engine_context (see 4.2.89), a Gas_turbine_engine_context (see 4.2.187), a Heat_exchanger_context (see 4.2.233), a Pump_context (see 4.2.398), or a Screw_propeller_context (see 4.2.433).

The data associated with a Product_context are the following:

- defined_for;
- owner_in_context;
- project_in_context;
- ship_in_context.

4.2.383.1 defined_for

The defined_for specifies a set of one to many mechanical products for which the context data are defined.

4.2.383.2 owner_in_context

The owner_in_context specifies the organisations that own the mechanical product.

4.2.383.3 project_in_context

The project_in_context specifies the projects associated with the mechanical product.

4.2.383.4 ship_in_context

The ship_in_context specifies the ship that is associated with the mechanical product.

4.2.384 Product_environment

A Product_environment is a type of Mechanical_product_property (see 4.2.322) and specifies the data that relate to the environment in which a product is operating.

The data associated with a Product_environment are the following:

- ambient_fluid;
- description.

4.2.384.1 ambient_fluid

The ambient_fluid specifies the fluid which fills the environment in which a mechanical product is operating.

4.2.384.2 description

The description specifies, as text, the description of the environment in which a mechanical product is operating.

4.2.385 Product_identification

A Product_identification is a type of Configuration_definition (see 4.2.38) and specifies the data needed for identification of a mechanical product. Within this part of ISO 10303 each Product_identification is either an Equipment_identification (see 4.2.135), a Generic_component_identification (see 4.2.217), or a Shaft_identification (see 4.2.461).

The data associated with a Product_identification are the following:

- defined_for;
- manufacturer;
- serial_number.

4.2.385.1 defined_for

The defined_for specifies a set of one to many mechanical products for which identification data are defined.

4.2.385.2 manufacturer

The manufacturer specifies the details of the organisation which is the manufacturer of the mechanical product.

4.2.385.3 serial_number

The serial_number specifies the manufacturer's serial number in the form of a label.

4.2.386 Product_material

A Product_material is a type of Physical_definition (see 4.2.348) that provides the concept for identification of the solid materials from which a mechanical product is made of.

The data associated with a Product_material are the following:

- defined_for;
- material_details.

4.2.386.1 defined_for

The defined_for specifies a set of one to many mechanical products for which material data are defined.

4.2.386.2 material_details

The material_details specifies the details of solid material by referencing a Solid_material (see 4.2.484) application object.

4.2.387 Product_participation

A Product_participation is a type of Product_structure_definition (see 4.2.391) that specifies the high level concept for all the definitions which relate to the belonging of a mechanical product to another higher level mechanical product in the decomposition hierarchy (see 3.10.31).

The data associated with a Product_participation are the following:

- defined_for;
- product_is_part_of.

4.2.387.1 defined_for

The defined_for specifies a set of one to many mechanical products for which participation data are defined.

4.2.387.2 product_is_part_of

The product_is_part_of specifies the higher level mechanical product, in the decomposition hierarchy, part of which this mechanical product is.

4.2.388 Product_placement

A Product_placement is a type of Product_structure_definition (see 4.2.391) that specifies the position and orientation of a mechanical product.

The data associated with a Product_placement are the following:

- defined_for;
- orientation;
- place_by_coordinate;
- place_by_ship_side;
- place_by_ship_space.

4.2.388.1 defined_for

The defined_for specifies a set of one to many mechanical products for which product placement and location data are defined.

4.2.388.2 orientation

The orientation specifies, as text, the orientation of the mechanical product.

4.2.388.3 place_by_coordinate

The place_by_coordinate specifies the position of the mechanical product within the context of a local co-ordinate system. A place_by_coordinate need not be specified for a particular Product_placement.

4.2.388.4 place_by_ship_side

The place_by_ship_side specifies the position and/or orientation of the mechanical product according to the side of the ship where it is located.

The value of ship_side shall be one of the following:

- aft;

- fore;
- port;
- starboard;
- user_defined_side_of_ship.

4.2.388.4.1 aft: the descriptor which specifies the side of the ship as aft (see 3.10.3).

4.2.388.4.2 forward: the descriptor which specifies the side of ship as fore (see 3.10.43).

4.2.388.4.3 port: the descriptor which specifies the side of ship as port.

4.2.388.4.4 starboard: the descriptor which specifies the side of ship as starboard.

4.2.388.4.5 user_defined_side_of_ship: the descriptor, set by the user, which specifies the side of ship if different from the other options.

4.2.388.5 place_by_ship_space

The place_by_ship_space specifies the compartment and/or space of the ship, within which the mechanical product is located. This is done via reference to Ship_space (see 4.2.475) application object.

4.2.389 Product_QA_requirement

A Product_QA_requirement is a type of Definition (see 4.2.77) and specifies the concept for defining all the data relating to quality requirements for a mechanical product.

The data associated with a Product_QA_requirement are the following:

- certificates;
- design_approval;
- reports_required;
- standards_rules_regulations;
- statutory_requirement;
- survey_inspection;
- tests.

4.2.389.1 certificates

The certificates attribute identifies a set of zero to many documents that contain details of certificates required to satisfy mechanical product quality procedure.

4.2.389.2 design_approval

The design_approval specifies a set of zero to many approval events that define the approval details of the mechanical product design.

4.2.389.3 reports_required

The reports_required identifies a set of zero to many documents that contain details of reports that must be submitted in order to satisfy mechanical product quality procedure.

4.2.389.4 standards_rules_regulations

The standards_rules_regulations identifies a set of zero to many documents that contain details of various standards, rules and regulations that must be followed in order to satisfy mechanical product quality procedure.

4.2.389.5 statutory_requirement

The statutory_requirement identifies a set of zero to many documents that contain details of statutory requirements that must be followed in order to satisfy mechanical product quality procedure.

4.2.389.6 survey_inspection

The survey_inspection specifies a set of zero to many survey and inspection tasks that have to be carried out in order to satisfy mechanical product quality procedure.

4.2.389.7 tests

The tests specify a set of zero to many test tasks that have to be carried out in order to satisfy mechanical product quality procedure.

4.2.390 Product_status

A Product_status is a type of Configuration_definition (see 4.2.38) and specifies the data which define the status and condition of a mechanical product.

The data associated with a Product_status are the following:

- defined_for;
- life_cycle_phase.

4.2.390.1 defined_for

The defined_for specifies a set of one to many mechanical products for which product status data are defined.

4.2.390.2 life_cycle_phase

The life_cycle_phase specifies the current stage in the life cycle of the mechanical product.

The value of life_cycle_phase shall be one of the following:

- design_phase;
- disposal_phase;
- installation_phase;
- manufacturing_phase;
- operation_phase;
- specification_phase.

4.2.390.2.1 design_phase: the descriptor which specifies that the product is at its design lifecycle phase of the lifecycle.

4.2.390.2.2 disposal_phase: the descriptor which specifies that the product is at its disposal phase of the lifecycle.

4.2.390.2.3 installation_phase: the descriptor which specifies that the product is at its installation phase of the lifecycle.

4.2.390.2.4 manufacturing_phase: the descriptor which specifies that the product is at its manufacturing phase of the lifecycle.

4.2.390.2.5 operation_phase: the descriptor which specifies that the product is at its operation phase of the lifecycle.

4.2.390.2.6 specification_phase: the descriptor which specifies that the product is at its specification phase of the lifecycle.

4.2.391 Product_structure_definition

A Product_structure_definition is a type of Definition (see 4.2.77) and specifies the high level concept for all the definitions (see 3.10.32) which are attributable to product structure (see 3.10.78). Within this part of ISO 10303 each Product_structure_definition is either a Product_assemblage (see 4.2.378), a Product_composition (see 4.2.379), a Product_connectivity (see 4.2.382), a Product_participation (see 4.2.388), or a Product_placement (see 4.2.388).

4.2.392 Property_BSU

A Property_BSU is a type of BSU (see 4.2.24) and specifies the identification information for referencing of a mechanical product property in an ISO 1584 compliant data dictionary.

The data associated with a Property_BSU are the following:

— name_scope.

The name_scope specifies the corresponding Class_BSU (see 4.2.31) to which the property is assigned. The name_scope need not be specified for a particular Property_BSU.

4.2.393 Propulsion_system

A Propulsion_system is a type of Mechanical_system (see 4.2.326) that specifies the high level concept for all the ship's propulsion systems (see 3.10.79) which need to be defined or described. A propulsion system is a system that produces required thrust for ship movement using fuel as the primary energy source.

The data associated with a Propulsion_system are the following:

— propulsion_system_type.

4.2.393.1 propulsion_system_type

The propulsion_system_type attribute specifies the type of propulsion system.

The value of propulsion_system_type shall be one of the following:

- `electrical_propulsion_system`;
- `mechanical_propulsion_system`.

4.2.393.1.1 `electrical_propulsion_system`: the descriptor that specifies that the propulsor (see 3.10.80) is driven by an electric motor via a mechanical transmission system.

4.2.393.1.2 `mechanical_propulsion_system`: the descriptor that specifies that the propulsor (see 3.10.80) is driven by a prime mover via a mechanical transmission system.

4.2.394 `Propulsion_system_general_characteristics`

A `Propulsion_system_general_characteristics` is a type of `Mechanical_system_general_characteristic` (see 4.2.328) and specifies the overall specifications and characteristics of a marine propulsion system.

The data associated with a `Propulsion_system_general_characteristics` are the following:

- `defined_for`;
- `no_of_engines_per_propeller`;
- `no_of_engines_per_shaft`;
- `propulsor_arrangement`;
- `propulsor_shaft_inclination`;
- `propulsor_shaft_location_on_ship`;
- `running_with_reduced_no_of_engines`.

4.2.394.1 `defined_for`

The `defined_for` specifies a set of one to many propulsion systems for which general characteristics are defined.

4.2.394.2 `no_of_engines_per_propeller`

The `no_of_engines_per_propeller` defines, as a whole number, the number of engines that are used to provide power to a propeller .

4.2.394.3 `no_of_engines_per_shaft`

The `no_of_engines_per_shaft` defines, as a whole number, the number of engines that are used to drive a shaft .

4.2.394.4 `propulsor_arrangement`

The `propulsor_arrangement` specifies as keyword the overall arrangement of the propulsor of a propulsion system.

The value of the `propulsor_arrangement` shall be one of the following:

- `multi_propulsor`;
- `single_propulsor`.

4.2.394.4.1 `multi_propulsor`: the descriptor that specifies the propulsion system consists of more than one propulsor.

4.2.394.4.2 single_propulsor: the descriptor that specifies the propulsion system consists of only one propulsor.

4.2.394.5 propulsor_shaft_inclination

The `propulsor_shaft_inclination` specifies, as text, the angle that the shaft is positioned in relative to horizontal plane.

4.2.394.6 propulsor_shaft_location_on_ship

The `propulsor_shaft_location_on_ship` specifies the exact position of the propulsor shaft on the hull using a ship's local co-ordinate system.

4.2.394.7 running_with_reduced_no_of_engines

The `running_with_reduced_no_of_engines` describes, as text, if the propulsor could be operated with a reduced number of engines or not.

4.2.395 Pump

A Pump is a type of Rotating_machinery (see 4.2.423) and specifies the concept for all the pumps that need to be defined.

The data associated with a Pump are the following:

- `pump_type`.

4.2.395.1 pump_type

The `pump_type` specifies the type of the pump.

The value of `pump_type` shall be one of the following:

- `rotary_pump`;
- `reciprocating_pump`;
- `user_define_pump_type`.

4.2.395.1.1 rotary_pump: the descriptor that specifies the pump is of type rotary pump and works according to rotating motion.

4.2.395.1.2 reciprocating_pump: the descriptor that specifies the pump is of type reciprocating pump and works according to reciprocating motion.

4.2.395.1.3 user_defined_pump_type: the descriptor, set by the user, that specifies the type of pump if different from the other options.

4.2.396 Pump_composition

A Pump_composition is a type of Machinery_composition (see 4.2.272) and specifies the composition (see 3.10.19) of a pump in terms of its constituent mechanical products.

The data associated with a Pump_composition are the following:

— defined_for.

The defined_for specifies a set of one to many pumps for which composition is defined.

4.2.397 Pump_connectivity

A Pump_connectivity is a type of Product_connectivity (see 4.2.382) and specifies the connectivity of a pump in terms of its connections to the other mechanical products at its boundary.

The data associated with a Pump_connectivity are the following:

— defined_for.

The defined_for specifies a set of one to many pumps for which connectivity is defined.

4.2.398 Pump_context

A Pump_context is a type of Product_context (see 4.2.383) and specifies the context, such as ship context and project context, within which the pump is used or considered.

The data associated with a Pump_context are the following:

— defined_for.

The defined_for specifies a set of one to many pumps for which context is defined.

4.2.399 Pump_design_characteristic

A Pump_design_characteristic is a type of Machinery_design_characteristic (see 4.2.273) and specifies the functional design data for a pump.

The data associated with a Pump_design_characteristic are the following:

- capacity_allowable_maximum;
- capacity_allowable_minimum;
- defined_for;
- design_performance_data;
- number_of_stages.

4.2.399.1 capacity_allowable_maximum

The capacity_allowable_maximum specifies the maximum pump capacity (volumetric flowrate) as specified during design, beyond which the pump should not be operated.

4.2.399.2 capacity_allowable_minimum

The capacity_allowable_minimum specifies the minimum pump capacity (volumetric flowrate) as specified during design, below which the pump should not be operated.

4.2.399.3 defined_for

The `defined_for` specifies a set of one to many pumps for which design characteristics are defined.

4.2.399.4 design_performance_data

The `design_performance_data` specifies a set of `Pump_performance_data` (see 4.2.409), representing the pump functional data at a number of pump operating conditions. There may be more than one `design_performance_data` for a `Pump_design_characteristic`.

4.2.399.5 number_of_stages

The `number_of_stages` specifies the total number of pumping stages. The `number_of_stages` need not be specified for a particular `Pump_design_characteristic`.

4.2.400 Pump_drawing

A `Pump_drawing` is a type of `Mechanical_product_drawing` (see 4.2.318) and specifies the concept for associating various types of drawings to a pump.

The data associated with a `Pump_drawing` are the following:

- `defined_for`.

The `defined_for` specifies a set of one to many pumps for which drawing is defined.

4.2.401 Pump_general_characteristic

A `Pump_general_characteristic` is a type of `Equipment_general_characteristic` (see 4.2.134) and specifies the pump overall specifications and characteristics.

The data associated with a `Pump_general_characteristic` are the following:

- `defined_for`;
- `drive_method`;
- `driving_machinery`;
- `lubrication_method`;
- `other_permissible_working_fluids`;
- `parallel_operation_requirements`;
- `pump_priming_conditions`;
- `pump_type_by_flow_direction`;
- `starting_conditions`;
- `working_fluid`.

4.2.401.1 defined_for

The `defined_for` specifies a set of one to many pumps for which general characteristics are defined.

4.2.401.2 drive_method

The `drive_method` specifies the method by which the pump is driven.

The value of the `drive_method` shall be one of the following:

- electric_drive
- mechanical_drive
- user_defined_drive.

4.2.401.2.1 electric_drive: the descriptor that specifies that the pump is driven by an electric motor.

4.2.401.2.2 mechanical_drive: the descriptor that specifies that the pump is driven by a mechanical machinery such as diesel engine and steam turbine.

4.2.401.2.3 user_defined_drive: the descriptor, set by the user, that specifies the pump drive method if different from the other options.

4.2.401.3 driving_machinery

The driving_machinery specifies the type of machine that is used for rotating the pump.

4.2.401.4 lubrication_method

The lubrication_method specifies, as text, the method by which the pump is being lubricated.

4.2.401.5 other_permmissible_working_fluids

The other_permmissible_working_fluids specifies a set of working fluids, that can be used as alternative working fluids for the pump. There may be more than one other_permmissible_working_fluids for a Pump_general_characteristic.

4.2.401.6 parallel_operation_requirements

The parallel_operation_requirements specifies, as text, if there is a requirement for another pump to operate in parallel to this pump.

4.2.401.7 pump_priming_conditions

The pump_priming_conditions specifies, as text, the conditions that need to be established for effective priming of the pump.

4.2.401.8 pump_type_by_flow_direction

The pump_type_by_flow_direction specifies the type of pump according to flow direction inside the pump.

The value of the pump_type_by_flow_direction shall be one of the following:

- axial_flow
- centrifugal
- mixed_flow.

4.2.401.8.1 axial_flow: the descriptor that specifies that the pump is of type axial flow. Fluid flows axially in this type of pump.

4.2.401.8.2 centrifugal: the descriptor that specifies that the pump is of type centrifugal. Fluid flows radially in this type of pump.

4.2.401.8.3 mixed_flow: the descriptor that specifies that the pump is of type mixed flow. Fluid flows in a direction in between axial and radial directions in this type of pump.

4.2.401.9 starting_conditions

The starting_conditions specifies, as text, the conditions and procedures that need to be established before starting the pump.

4.2.401.10 working_fluid

The working_fluid specifies the pump working fluid.

4.2.402 Pump_identification

A Pump_identification is a type of Equipment_identification (see 4.2.135) and specifies the data for identification of the pump.

The data associated with a Pump_identification are the following:

— defined_for.

The defined_for specifies a set of one to many pumps for which identification is defined.

4.2.403 Pump_jet_propulsor

A Pump_jet_propulsor is a type of Mechanical_system (see 4.2.326) and specifies the concept for defining all the pump-jet propulsors that need to be defined. A pump-jet propulsor is a pump system which accelerates large volumes of water, drawn in from beneath the ship and expels it as a high speed horizontal jet, setting up sufficient reaction force to propel the vessel.

4.2.404 Pump_mass_weight_inertia

A Pump_mass_weight_inertia is a type of Mass_weight_inertia (see 4.2.297) and specifies the mass, weight and inertia for the pump.

The data associated with a Pump_mass_weight_inertia are the following:

— defined_for.

The defined_for specifies a set of one to many pumps for which mass, weight and inertia are defined.

4.2.405 Pump_operational_characteristic

A Pump_operational_characteristic is a type of Operational_characteristic (see 4.2.341) and specifies a high level concept for all the pump-related operational data.

The data associated with a Pump_operational_characteristic are the following:

— defined_for.

The defined_for specifies a set of one to many pumps for which operational characteristics are defined.

4.2.406 Pump_operational_performance_data

A Pump_operational_performance_data is a type of Pump_operational_characteristic (see 4.2.405) and specifies the functional performance data for pump operation.

The data associated with a Pump_operational_performance_data are the following:

- operational_performance_data.

The operational_performance_data specifies a set of Pump_performance_data (see 4.2.409), representing the pump functional data at a number of operating conditions. There may be more than one operational_performance_data for a Pump_operational_performance_data.

4.2.407 Pump_overall_dimension

A Pump_overall_dimension is a type of Overall_dimension (see 4.2.345) and specifies the overall length, breadth and height of the pump.

The data associated with a Pump_overall_dimension are the following:

- defined_for.

The defined_for specifies a set of one to many pumps for which overall dimensions are defined.

4.2.408 Pump_overall_operational_data

A Pump_overall_operational_data is a type of Machinery_overall_operational_data (see 4.2.275) and specifies the overall operational data including energy consumption and operating hours for a pump.

4.2.409 Pump_performance_data

A Pump_performance_data is a type of Machinery_performance_data (see 4.2.276) and specifies the functional performance parameters for a pump.

The data associated with a Pump_performance_data are the following:

- capacity;
- cooling_water_data;
- inlet_temperature;
- lub_oil_data;
- net_positive_suction_head;
- pressure_ratio;
- working_fluid_data.

4.2.409.1 capacity

The capacity specifies the pump throughput volumetric flowrate.

4.2.409.2 cooling_water_data

The `cooling_water_data` specifies a set of fluid flow data, if any, that define the cooling water conditions at various positions in the pump. There may be more than one `cooling_water_data` for a `Pump_working_fluid_data`.

4.2.409.3 inlet_temperature

The `inlet_temperature` specifies the working fluid temperature at pump inlet.

4.2.409.4 net_positive_suction_head

The `net_positive_suction_head` specifies the pump net positive suction head based on working fluid density. The net positive suction head is specified in terms of height of column of working fluid.

4.2.409.5 lube_oil_data

The `lube_oil_data` specifies a set of fluid flow data, if any, that define the lubrication oil conditions at various positions in the pump. There may be more than one `lube_oil_data` for a `Pump_lube_oil_data`.

4.2.409.6 pressure_ratio

The `pressure_ratio` specifies the working fluid pressure ratio across the pump. It is the ratio of outlet pressure to inlet pressure.

4.2.409.7 working_fluid_data

The `working_fluid_data` specifies a set of fluid flow data, if any, that define the working fluid conditions at various positions in the pump. There may be more than one `working_fluid_data` for a `Pump_working_fluid_data`.

4.2.410 Pump_placement

A `Pump_placement` is a type of `Product_placement` (see 4.2.388) and specifies the position of the pump on the ship in terms of ship compartment and co-ordinate system.

The data associated with a `Pump_placement` are the following:

— `defined_for`.

The `defined_for` specifies a set of one to many pumps for which placement is defined.

4.2.411 Pump_status

A `Pump_status` is a type of `Product_status` (see 4.2.390) and specifies the status of a pump in terms of its life-cycle phase.

The data associated with a `Pump_status` are the following:

— `defined_for`.

The `defined_for` specifies a set of one to many pumps for which status is defined.

4.2.412 Purifier

A Purifier is a type of `Process_machinery` (see 4.2.374) and specifies the concept for all the purifiers that need to be defined. A purifier is a device that clears an area or object of all undesirable matter.

4.2.413 RAM_characteristic

A `RAM_characteristic` is a type of `Engineering_analysis_definition` (see 4.2.131) that specifies the high level concept for reliability, availability and maintainability characteristics (see 3.10.83) which are attributable to a mechanical product. Within this part of ISO 10303 each `RAM_characteristic` is either an `Availability_characteristic` (see 4.2.14), a `Maintainability_characteristic` (see 4.2.279), or a `Reliability_characteristic` (see 4.2.417).

The data associated with the `RAM_characteristic` are the following:

- `defined_for`;
- `product_condition_of_use`.

4.2.413.1 defined_for

The `defined_for` specifies a set of one to many mechanical products for which the RAM characteristics are defined.

4.2.413.2 product_condition_of_use

The `product_condition_of_use` specifies, as text, the overall conditions under which the product is used.

4.2.414 Ratio

A Ratio is a type of `Measure_with_unit` (see 4.2.305) where the physical quantity is a ratio as defined in ISO 31 (clause 2).

The data associated with a Ratio are the following:

- `ratio_unit`.

The `ratio_unit` attribute specifies all the units in which the ratio of the two physical quantities is measured.

4.2.415 Real_value

The `Real_value` specifies that the property value is of type real.

The data associated with a `Real_value` are the following:

- `the_value`.

The `the_value` specifies the value of the property in the form of a real number.

4.2.416 Reciprocating_machinery

A Reciprocating_machinery is a type of Mechanical_machinery (see 4.2.312) that provides the high level concept for all types of ship reciprocating machinery (see 3.10.84) which need to be defined.

4.2.417 Reliability_characteristic

A Reliability_characteristic is a type of RAM_characteristic (see 4.2.413) that specifies the data that are attributable to the reliability performance of a mechanical product.

The data associated with a Reliability_characteristic are the following:

- mean_failure_rate;
- mean_operating_time_between_failure;
- mean_time_between_failure;
- mean_time_to_failure;
- related_time_data;
- reliability.

4.2.417.1 mean_failure_rate

The mean_failure_rate specifies the reliability performance of a mechanical product in terms of its mean failure rate (see 3.7).

4.2.417.2 mean_operating_time_between_failure

The mean_operating_time_between_failure specifies the mean value for the time between consecutive failures. The mean_operating_time_between_failure need not be specified for a particular Reliability_characteristic.

4.2.417.3 mean_time_between_failure

The mean_time_between_failure specifies the reliability performance of a mechanical product in terms of its mean time between failures (see 3.7).

4.2.417.4 mean_time_to_failure

The mean_time_to_failure specifies the reliability performance of a mechanical product in terms of its mean time to failures (see 3.7).

4.2.417.5 related_time_data

The related_time_data specifies all other related time data, if any, that are used to estimate the product reliability characteristics. There may be more than one related_time_data for a Reliability_characteristic.

4.2.417.6 reliability

The reliability specifies the reliability performance (see 3.7) of a mechanical product.

4.2.418 Restricted_water

A Restricted_water is a type of Item (see 4.2.253) and specifies the concept for defining a restricted water area such as rivers and canals where ship passes through during its voyage.

4.2.419 Revision

A Revision specifies a collection of definitional entities that together are the subject of a version control.

The data associated with a Revision are the following:

- context_item;
- definition_relationships;
- members;
- name;
- reason;
- version_identifier.

4.2.419.1 context_item

The context_item specifies the main context, such as the mechanical product, for a revision.

4.2.419.2 definition_relationships

The definition_relationships specify a set of zero to many Definition_relationship (see 4.2.78) that together are a part of a revision. There may be more than one definition_relationships for a Revision.

4.2.419.3 members

The members attribute specifies a set of zero to many Definition (see 4.2.77) that together are part of a revision. There may be more than one members for a Revision.

4.2.419.4 name

The name specifies, as text, a user identifiable name for the revision.

4.2.419.5 reason

The reason specifies, as text, the reason for creating the revision. The reason need not be specified for a particular Revision.

4.2.419.6 version_identifier

The version_identifier specifies, as text, the identifier for the particular version of the revision. The version_identifier need not be specified for a particular Revision.

4.2.420 Rod

A Rod is a type of Connecting_component (see 4.2.39) and specifies the concept for all the mechanical parts known as rods that need to be defined. In a machinery a rod is used as a structural part that is usually subject to tensile stress only.

4.2.421 Rotating_component

A Rotating_component is a type of Mechanical_product_component (see 4.2.316) and specifies the concept for all the rotating components that need to be defined.

4.2.422 Rotating_component_operational_characteristic

A Rotating_component_operational_characteristic specifies the operational data for any rotating component.

The data associated with a Rotating_component_operational_characteristic are the following:

- defined_for;
- rotational_speed.

4.2.422.1 defined_for

The defined_for specifies a set of one to many rotating components for which operational characteristics are defined.

4.2.422.2 rotational_speed

The rotational_speed specifies the magnitude of the speed of rotation of the rotating component.

4.2.423 Rotating_machinery

A Rotating_machinery is a type of Mechanical_machinery (see 4.2.312) that provides the high level concept for all the ship rotating non-electrical machinery that need to be defined.

4.2.424 Rotational_damping_coefficient

A Rotational_damping_coefficient is a type of Measure_with_unit (see 4.2.305) where the physical quantity is rotational damping coefficient. In a rotating system subject to viscous damping, the rotational damping coefficient is defined as the torque resisting the motion per unit angular velocity.

A data associated with a Rotational_damping_coefficient are the following:

- rotational_damping_coefficient_unit.

The rotational_damping_coefficient_unit specifies all the units that can be used for quantifying the rotational damping coefficient.

4.2.425 Rotational_speed

A Rotational_speed is a type of Measure_with_unit (see 4.2.305) where the physical quantity is the speed of rotation.

The data associated with a Rotational_speed are the following:

— rotational_speed_unit.

The rotational_speed_unit specifies all the units for the rotational speed.

4.2.426 Rotational_stiffness

A Rotational_stiffness is a type of Measure_with_unit (see 4.2.305) where the physical quantity is the material rotational stiffness. In a mechanical vibrating system, rotational stiffness is the restoring torque per unit angular deflection.

A data associated with a Rotational_stiffness are the following:

— rotational_stiffness_unit.

The rotational_stiffness_unit specifies all the units that can be used for quantifying the rotational stiffness.

4.2.427 Rudder

A Rudder is a type of Mechanical_component (see 4.2.306) and specifies the concept for all the rudders that need to be defined. A rudder is a flat piece of wood or metal that is attached vertically to the stern of a ship and operates to control the ship's direction.

4.2.428 Rudder_system

A Rudder_system is a type of Mechanical_system (see 4.2.326) and specifies the concept for defining all the rudder systems that need to be defined. A rudder system comprises rudder, shaft (stock), bearing and associated components, and is part of the ship manoeuvring system.

4.2.429 Safety_system

A Safety_system is a type of Mechanical_system (see 4.2.326) and specifies the concept for defining all the safety systems that need to be defined. A safety system provides a means for automatically altering the operating conditions of equipment, upon receipt of a certain alarm signal, to prevent damage to the equipment.

4.2.430 Screw_propeller

A Screw_propeller is a type of Rotating_machinery (see 4.2.423) and specifies the data representation concept for all the screw propellers which need to be defined. A screw propeller is a device that creates the required thrust for ship movements while rotating in the water.

The data associated with a Screw_propeller are the following:

– propeller_type.

The `propeller_type` specifies, as text, the general type of propeller.

4.2.431 Screw_propeller_composition

A `Screw_propeller_composition` is a type of `Machinery_composition` (see 4.2.272) and specifies the product composition (see 3.10.19) data which are attributable to all types of screw propellers.

The data associated with a `Screw_propeller_composition` are the following:

- `defined_for`;
- `number_of_blades`.

4.2.431.1 defined_for

The `defined_for` specifies a set of one to many screw propellers for which composition data are defined.

4.2.431.2 number_of_blades

The `number_of_blades` specifies the number of blades for the propeller.

4.2.432 Screw_propeller_connectivity

A `Screw_propeller_connectivity` is a type of `Product_connectivity` (see 4.2.382) and specifies the connectivity of a screw propeller in terms of its connections to the other mechanical products at its boundary.

The data associated with a `Screw_propeller_connectivity` are the following:

- `defined_for`.

The `defined_for` specifies a set of one to many screw propellers for which connectivity is defined.

4.2.433 Screw_propeller_context

A `Screw_propeller_context` is a type of `Product_context` (see 4.2.383) and specifies the context, such as ship context and project context, within which the screw propeller is used or considered.

The data associated with a `Screw_propeller_context` are the following:

- `defined_for`.

The `defined_for` specifies a set of one to many screw propellers for which context is defined.

4.2.434 Screw_propeller_design_characteristic

A `Screw_propeller_design_characteristic` is a type of `Equipment_design_characteristic` (see 4.2.133) and specifies the functional design data for a screw propeller.

The data associated with a `Screw_propeller_design_characteristic` are the following:

- `defined_for`;

- design_performance_data;
- max_ahead_pitch;
- max_astern_pitch.

4.2.434.1 defined_for

The defined_for specifies a set of one to many screw propellers for which design characteristics are defined.

4.2.434.2 design_performance_data

The design_performance_data specifies a set of Screw_propeller_performance_data (see 4.2.442), representing the screw propeller functional data at a number of operating conditions. There may be more than one design_performance_data for a Screw_propeller_design_characteristic.

4.2.434.3 max_ahead_pitch

The max_ahead_pitch specifies maximum propeller pitch in an ahead direction according to design.

4.2.434.4 max_astern_pitch

The max_astern_pitch specifies maximum propeller pitch in an astern direction according to design.

4.2.435 Screw_propeller_drawing

A Screw_propeller_drawing is a type of Mechanical_product_drawing (see 4.2.318) and specifies the concept for associating various types of drawings to a screw propeller.

The data associated with a Screw_propeller_drawing are the following:

- defined_for.

The defined_for specifies a set of one to many screw propellers for which the drawing is defined.

4.2.436 Screw_propeller_general_characteristic

A Screw_propeller_general_characteristic is a type of Equipment_general_characteristic (see 4.2.134) and specifies the data representation concept for all the general characteristics (see 3.10.49) which are attributable to all types of screw propellers.

The data associated with a Screw_propeller_general_characteristic are the following:

- defined_for;
- fit_of_hub_to_shaft;
- hub_type;
- pitch_control_mechanism_description;
- propeller_type_by_blade_outline.
- propeller_type_by_design_configuration;
- propeller_type_by_duct;
- propeller_type_by_pitch;
- special_features;

— type_of_construction.

4.2.436.1 defined_for

The defined_for specifies a set of one to many screw propellers for which the general characteristics are defined.

4.2.436.2 fit_of_hub_to_shaft

The fit_of_hub_to_shaft attribute specifies, as text, the information on the hub fit to a shaft.

4.2.436.3 hub_type

The hub_type specifies, as text, the type of propeller hub.

4.2.436.4 pitch_control_mechanism_description

The pitch_control_mechanism_description specifies, as text, the detailed description of the blade pitch control mechanism. The pitch_control_mechanism_description need not be specified for a particular Screw_propeller_general_characteristic.

4.2.436.5 propeller_type_by_blade_outline

The propeller_type_by_blade_outline specifies the type of propeller blade outline.

The value of propeller_type_by_blade_outline shall be one of the following:

- conventional;
- skewed;
- user_defined_blade_outline_type.

4.2.436.5.1 conventional: the descriptor which specifies the propeller blade outline to be of type conventional.

4.2.436.5.2 skewed: the descriptor which specifies the propeller blade outline to be of type highly skewed.

4.2.436.5.3 user_defined_blade_outline_type: the descriptor, set by the user, which specifies the outline type of propeller blade if different from the other options.

4.2.436.6 propeller_type_by_design_configuration

The propeller_type_by_design_configuration specifies the type of propeller according to design configuration.

The value of propeller_type_by_design_configuration shall be one of the following:

- contra_rotating;
- conventional;
- user_defined;
- vane_wheel.

4.2.436.6.1 contra_rotating: the descriptor which specifies the type of propeller design configuration as contra-rotating. It is applied to a pair of propellers mounted on concentric shafts and rotating in opposite directions.

4.2.436.6.2 conventional: the descriptor which specifies the type of propeller design configuration as conventional.

4.2.436.6.3 user_defined: the descriptor, set by the user, which specifies the type of propeller design configuration if different from the other options.

4.2.436.6.4 vane_wheel: the descriptor which specifies the type of propeller design configuration as vane-wheel.

4.2.436.7 propeller_type_by_duct

The `propeller_type_by_duct` specifies whether a propeller is of type ducted or non-ducted.

The value of `propeller_type_by_duct` shall be one of the following:

- `ducted_fixed`;
- `ducted_steerable`;
- `non_ducted`.

4.2.436.7.1 ducted_fixed: the descriptor which specifies that the propeller is ducted. The duct is fixed in this case.

4.2.436.7.2 ducted_steerable: the descriptor which specifies that the propeller is ducted. The duct is steerable in this case.

4.2.436.7.3 non_ducted: the descriptor which specifies that the propeller is non-ducted.

4.2.436.8 propeller_type_by_pitch

The `propeller_type_by_pitch` specifies the type of propeller by its pitch.

The value of `propeller_type_by_pitch` shall be one of the following:

- `adjustable_pitch`;
- `controllable_pitch`;
- `fixed_pitch`.

4.2.436.8.1 adjustable_pitch: the descriptor which specifies that the propeller pitch can be adjusted manually at a dry dock.

4.2.436.8.2 controllable_pitch: the descriptor which specifies that the propeller pitch can be controlled automatically.

4.2.436.8.3 fixed_pitch: the descriptor which specifies that the propeller pitch is fixed.

4.2.436.9 special_features

The `special_features` specifies, as text, any additional special features that the propeller has.

4.2.436.10 type_of_construction

The type_of_construction specifies the type of construction of a screw propeller.

The value of type_of_construction shall be one of the following:

- built_up;
- monoblock;
- user_defined_type_of_construction.

4.2.436.10.1 built_up: the descriptor which specifies the method of construction to be of type built-up.

4.2.436.10.2 monoblock: the descriptor which specifies the method of construction to be of type monoblock.

4.2.436.10.3 user_defined_type_of_construction: the descriptor, set by the user, which specifies the type of construction if different from the other options.

4.2.437 Screw_propeller_identification

A Screw_propeller_identification is a type of Equipment_identification (see 4.2.135) and specifies the data for identification of the screw propeller.

The data associated with a Screw_propeller_identification are the following:

- defined_for.

The defined_for specifies a set of one to many screw propellers for which identification data are defined.

4.2.438 Screw_propeller_mass_weight_inertia

A Screw_propeller_mass_weight_inertia is a type of Mass_weight_inertia (see 4.2.297) and specifies the mass, weight and inertia for a screw propeller.

The data associated with a Screw_propeller_mass_weight_inertia are the following:

- defined_for;
- inertia_in_water;
- weight_including_water.

4.2.438.1 defined_for

The defined_for specifies a set of one to many screw propellers for which mass-related data are defined.

4.2.438.2 inertia_in_water

The inertia_in_water specifies the propeller mass moment of inertia when in water (including entrained water).

4.2.438.3 weight_including_water

The weight_including_water attribute specifies the weight of the propeller inclusive of entrained water.

4.2.439 Screw_propeller_operational_characteristic

A Screw_propeller_operational_characteristic is a type of Operational_characteristic (see 4.2.341) and specifies the high level concept for all the screw propeller-related operational data.

The data associated with a Screw_propeller_operational_characteristic are the following:

- defined_for.

The defined_for specifies a set of one to many screw propellers for which operational characteristics are defined.

4.2.440 Screw_propeller_operational_performance_data

The Screw_propeller_operational_performance_data is a type of Screw_propeller_operational_characteristic (see 4.2.439) and specifies the functional performance data for a screw propeller operation.

The data associated with a Screw_propeller_operational_performance_data are the following:

- operational_performance_data.

The operational_performance_data specifies a set of Screw_propeller_performance_data (see 4.2.442) representing propeller data at a number of operating conditions. There may be more than one operational_performance_data for a particular Screw_propeller_operational_performance_data.

4.2.441 Screw_propeller_overall_dimension

The Screw_propeller_overall_dimension is a type of Overall_dimension (see 4.2.345) that specifies the data representation concept for collecting all the overall dimensions which are attributable to all types of screw propellers.

The data associated with a Screw_propeller_overall_dimension are the following:

- blade_thickness_at_centreline;
- defined_for;
- expanded_surface_area_ratio;
- hub_to_diameter_ratio;
- immersion_in_ballast_condition;
- immersion_in_loaded_condition;
- maximum_diameter;
- mean_pitch_diameter_ratio;
- nominal_design_pitch_diameter_ratio;
- rake_angle;
- shaft_height;
- skew_angle;
- tip_clearance_to_hull.

4.2.441.1 blade_thickness_at_centreline

The `blade_thickness_at_centreline` specifies the thickness of the propeller blade at its centreline. There may be more than one `blade_thickness_at_centreline` for a `Screw_propeller_overall_dimension`.

4.2.441.2 defined_for

The `defined_for` specifies a set of one to many screw propellers for which overall dimensions are defined.

4.2.441.3 expanded_surface_blade_area_ratio

The `expanded_surface_blade_area_ratio` specifies the ratio of the total expanded surface area of the blades to the propeller projected area (area of the propeller disk).

4.2.441.4 hub_to_diameter_ratio

The `hub_to_diameter_ratio` specifies the ratio of the hub diameter to propeller diameter.

4.2.441.5 immersion_in_ballast_condition

The `immersion_in_ballast_condition` specifies the depth of propeller immersion, as measured relative to centreline of propeller, when the ship is under ballast condition.

4.2.441.6 immersion_in_loaded_condition

The `immersion_in_loaded_condition` specifies the depth of propeller immersion, as measured relative to centreline of propeller, when the ship is under loaded condition.

4.2.441.7 maximum_diameter

The `maximum_diameter` specifies the propeller maximum diameter.

4.2.441.8 mean_pitch_diameter_ratio

The `mean_pitch_diameter_ratio` specifies the ratio of propeller mean pitch to propeller diameter. A `mean_pitch_diameter_ratio` need not be specified for a particular `Screw_propeller_overall_dimension`.

4.2.441.9 nominal_design_pitch_diameter_ratio

The `nominal_design_pitch_diameter_ratio` specifies the ratio of the nominal mean design pitch to propeller diameter.

4.2.441.10 rake_angle

The `rake_angle` specifies the propeller rake angle.

4.2.441.11 shaft_height

The `shaft_height` specifies the distance between propeller shaft centre and ship baseline.

4.2.441.12 skew_angle

The skew_angle specifies the propeller skew angle.

4.2.441.13 tip_clearance_to_hull

The tip_clearance_to_hull specifies the clearance length (minimum distance) between propeller tip and hull.

4.2.442 Screw_propeller_performance_data

A Screw_propeller_performance_data is a type of Machinery_performance_data (see 4.2.276) that specifies the functional performance parameters for a screw propeller.

The data associated with a Screw_propeller_performance_data are the following:

— pitch.

The pitch specifies the propeller pitch for the operating condition.

4.2.443 Screw_propeller_placement

A Screw_propeller_placement is a type of Product_placement (see 4.2.388) and specifies the position of the screw propeller on the ship in terms of ship compartment and co-ordinate system.

The data associated with a Screw_propeller_placement are the following:

— defined_for.

The defined_for specifies a set of one to many screw propellers for which the placement data are defined.

4.2.444 Screw_propeller_status

A Screw_propeller_status is a type of Product_status (see 4.2.390) and specifies the status of a screw propeller in terms of its life-cycle phase.

The data associated with a Screw_propeller_status are the following:

— defined_for.

The defined_for specifies a set of one to many screw propellers for which the status data are defined.

4.2.445 Sea

A Sea is a type of Item (see 4.2.253) and specifies the concept for defining a sea or an ocean within the context of this part of ISO 10303.

4.2.446 Sea_port

A Sea_port is a type of Item (see 4.2.253) and specifies the concept for defining sea ports and harbours where the ship stays during its voyage.

The data associated with a Sea_port are the following:

— port_name.

The port_name specifies the name and descriptive details of the port.

4.2.447 Seal

A Seal is a type of Connecting_component (see 4.2.39) and specifies the concept for all the seals that need to be defined. Seals are used to avoid leakage in fluid systems.

4.2.448 Sensor

A Sensor is a type of Control_component (see 4.2.43) and specifies the concept for all the sensors that need to be defined. A sensor is used to measure a physical parameter. Within this part of ISO 10303, each sensor is either a Pressure_sensor (see 4.2.367), a Temperature_sensor (see 4.2.528), a Torque_sensor (see 4.2.540), a Speed_sensor (see 4.2.492) or a Flowrate_sensor (see 4.2.165).

4.2.449 Separator

A Separator is a type of Process_machinery (see 4.2.374) and specifies the concept for all the separators that need to be defined. A separator is a pressure vessel used to separate the gaseous and liquid components of reservoir fluids into gas, oil and water.

4.2.450 Shaft

A Shaft is a type of Rotating_component (see 4.2.421) and specifies the concept for all the shafts that need to be defined. A shaft is a circular section beam transmitting rotary motion between its driven end and load.

The data associated with a Shaft are the following:

— the_type.

The the_type specifies, as text, the type of the shaft.

4.2.451 Shaft_brake

A Shaft_brake is a type of Mechanical_component (see 4.2.306) and specifies the concept for all the shaft brakes that need to be defined. A shaft brake is a device designed to slow or stop the rotation of a shaft by the use of friction in a controlled manner.

4.2.452 Shaft_composition

A Shaft_composition is a type of Product_composition (see 4.2.379) and specifies the composition (see 3.10.19) of a gear box in terms of its constituent mechanical products.

The data associated with a Shaft_composition are the following:

— defined_for.

The `defined_for` specifies a set of one to many shafts for which composition is defined.

4.2.453 Shaft_connectivity

A `Shaft_connectivity` is a type of `Product_connectivity` (see 4.2.382) and specifies the connectivity of a shaft in terms of its connections to the other mechanical products at its boundary.

The data associated with a `Shaft_connectivity` are the following:

- `defined_for`.

The `defined_for` specifies a set of one to many shafts for which connectivity is defined.

4.2.454 Shaft_coupling

A `Shaft_coupling` is a type of `Mechanical_equipment` (see 4.2.310) and specifies the concept for defining all the shaft couplings that need to be defined. A shaft coupling is a device used to connect coaxial shafts for power transmission from one to the other. Within this part of ISO 10303, each `Shaft_coupling` is either a `Flexible_coupling` (see 4.2.164), a `Fluid_coupling` (see 4.2.167), or a `Solid_coupling` (see 4.2.483).

4.2.455 Shaft_design_characteristic

A `Shaft_design_characteristic` is a type of `Machinery_design_characteristic` (see 4.2.273) and specifies the functional design data for a shaft.

The data associated with a `Shaft_design_characteristic` are the following:

- `defined_for`;
- `design_shaft_performance_data_nominal`;
- `design_shaft_performance_data_maximum`.

4.2.455.1 defined_for

The `defined_for` specifies a set of one to many shafts for which design characteristics are defined.

4.2.455.2 design_shaft_performance_data_nominal

The `design_shaft_performance_data_nominal` specifies the nominal performance data such as power, torque and rotational speed for the shaft, according to design.

4.2.455.3 design_shaft_performance_data_maximum

The `design_shaft_performance_data_maximum` specifies the maximum performance data such as power, torque and rotational speed for the shaft, according to design.

4.2.456 Shaft_drawing

A `Shaft_drawing` is a type of `Mechanical_product_drawing` (see 4.2.318) and specifies the concept for associating various types of drawings to a shaft.

The data associated with a `Shaft_drawing` are the following:

— defined_for.

The defined_for specifies a set of one to many shafts for which drawing is defined.

4.2.457 Shaft_end

A Shaft_end is a type of Mechanical_connector (see 4.2.309) and specifies the concept for all the shaft ends that need to be defined. Within this part of ISO 10303, a shaft end is the end part of the shaft that is used for connecting the shaft to another device.

The data associated with a Shaft_end are the following:

— shaft_end_type;

4.2.457.1 shaft_end_type

The shaft_end_type specifies the type of the shaft end.

The value of shaft_end_type shall be one of the following:

— flanged_end;
— keyed_end;
— welded_end,;

4.2.457.1.1 flanged_end: the descriptor that specifies that the connection at the shaft end with another mechanical product is achieved with a flange.

4.2.457.1.2 keyed_end: the descriptor that specifies that the connection at the shaft end with another mechanical product is achieved by matching a specially cut end.

4.2.457.1.3 welded_end: the descriptor that specifies that the connection at the shaft end with another mechanical product is achieved with a weld.

4.2.458 Shaft_journal

A Shaft_journal is a type of Mechanical_connector (see 4.2.309) and specifies the concept for all the shaft journals that need to be defined. A shaft journal is that part of the shaft that is supported by a bearing in which it rotates.

4.2.459 Shaft_general_characteristic

A Shaft_general_characteristic is a type of Equipment_general_characteristic (see 4.2.134) and specifies the shaft overall specifications and characteristics.

The data associated with a Shaft_general_characteristic are the following:

— defined_for.

The defined_for specifies a set of one to many shafts for which general characteristics are defined.

4.2.460 Shaft_generator_system

A `Shaft_generator_system` is a type of `Electric_power_generation_system` (see 4.2.118) and specifies the concept for defining all the marine electric generators that use part of ship main propulsion shaft energy for driving an electric generator. A shaft generator system uses the ship main engines as its prime mover.

4.2.461 Shaft_identification

A `Shaft_identification` is a type of `Product_identification` (see 4.2.385) and specifies the data for identification of the shaft.

The data associated with a `Shaft_identification` are the following:

- `defined_for`.

The `defined_for` specifies a set of one to many shafts for which identification is defined.

4.2.462 Shaft_mass_weight_inertia

A `Shaft_mass_weight_inertia` is a type of `Mass_weight_inertia` (see 4.2.297) and specifies the mass, weight and inertia for the shaft.

The data associated with a `Shaft_mass_weight_inertia` are the following:

- `defined_for`.

The `defined_for` specifies a set of one to many shafts for which mass, weight and inertia are defined.

4.2.463 Shaft_operational_characteristic

A `Shaft_operational_characteristic` is a type of `Operational_characteristic` (see 4.2.341) and specifies the shaft-related operational data.

The data associated with a `Shaft_operational_characteristic` are the following:

- `defined_for`;
- `operational_shaft_performance_data`;
- `thrust`.

4.2.463.1 defined_for

The `defined_for` specifies a set of one to many shafts for which operational characteristics are defined.

4.2.463.2 operational_shaft_performance_data

The `operational_shaft_performance_data` specifies the operational performance of the shaft in terms of its transmitted power, torque and rotational speed.

4.2.463.3 thrust

The `thrust` specifies the magnitude of the thrust on the shaft during normal operation. The thrust need not be specified for a particular `Shaft_operational_characteristic`.

4.2.464 Shaft_overall_dimension

A Shaft_overall_dimension is a type of Overall_dimension (see 4.2.345) and specifies the overall length, breadth and height of the shaft.

The data associated with a Shaft_overall_dimension are the following:

- defined_for.

The defined_for specifies a set of one to many shafts for which overall dimensions are defined.

4.2.465 Shaft_placement

A Shaft_placement is a type of Product_placement (see 4.2.388) and specifies the position of the shaft in terms of ship compartment and co-ordinate system.

The data associated with a Shaft_placement are the following:

- bearing_positions;
- defined_for.

4.2.465.1 bearing_positions

The bearing_positions specifies, as text, the position of shaft bearings relative to the shaft length.

4.2.465.2 defined_for

The defined_for specifies a set of one to many shafts for which placement is defined.

4.2.466 Ship

A Ship is a type of Item (see 4.2.253) that specifies the ship concerned. All data defining the product must be related to a ship, which might exist in any life cycle stage.

The data associated with a Ship are the following:

- ship_type.

The ship_type specifies, as text, the type of the ship.

4.2.467 Ship_at_port

A Ship_at_port specifies information about a ship voyage in relation to its port visits and stays.

The data associated with a Ship_at_port are the following:

- delay;
- sea_port;
- schedule_at_port.

4.2.467.1 delay

The delay specifies time spent in the port in excess of the planned time.

4.2.467.2 sea_port

The sea_port specifies a particular Sea_port (see 4.2.446) where the ship is visiting or staying.

4.2.467.3 schedule_at_port

The schedule_at_port specifies a Time_schedule (see 4.2.536), representing the schedule that the ship is expected to follow, or has actually followed, during its stay at a port.

4.2.468 Ship_at_restricted_water

A Ship_at_restricted_water specifies information about a ship voyage in relation to its journey through a Restricted_water (see 4.2.418).

The data associated with a Ship_at_restricted_water are the following:

- delay;
- restricted_water;
- schedule_at_restricted_water.

4.2.468.1 delay

The delay specifies time spent in restricted water area in excess of planned time.

4.2.468.2 restricted_water

The restricted_water specifies a particular Restricted_water (see 4.2.418) area where the ship is travelling through.

4.2.468.3 schedule_at_restricted_water

The schedule_at_restricted_water specifies a Time_schedule (see 4.2.536) that the ship is expected to follow, or has actually followed, during its journey at restricted water area.

4.2.469 Ship_at_sea

A Ship_at_sea specifies information about a ship voyage in relation to its journey at a specific Sea (see 4.2.445).

The data associated with a Ship_at_sea are the following:

- delay;
- schedule_at_sea;
- sea.

4.2.469.1 delay

The delay specifies time spent at sea in excess of planned time.

4.2.469.2 schedule_at_sea

The schedule_at_sea specifies a Time_schedule (see 4.2.536) that the ship is expected to follow, or has actually followed, during its journey at sea.

4.2.469.3 sea

The sea specifies a particular Sea (see 4.2.445) where the ship is making its journey.

4.2.470 Ship_at_shipyard

A Ship_at_shipyard specifies information about a ship voyage in relation to its visits or stays at a Shipyard (see 4.2.477).

The data associated with a Ship_at_shipyard are the following:

- delay;
- schedule_at_shipyard;
- shipyard.

4.2.470.1 delay

The delay specifies time spent at a shipyard in excess of planned time.

4.2.470.2 schedule_at_shipyard

The schedule_at_shipyard specifies a Time_schedule (see 4.2.536) that the ship is expected to follow, or has actually followed, during the stay at a shipyard.

4.2.470.3 shipyard

The shipyard specifies a particular Shipyard (see 4.2.477) where the ship is visiting or staying.

4.2.471 Ship_designation

A Ship_designation is a type of Ship_general_characteristic (see 4.2.472) and specifies the identification given to the ship in order that it can be categorised by any shipping related organisation.

The data associated with a Ship_designation are the following:

- call_sign;
- date_placed_in_service;
- defined_for;
- flag_state;
- port_of_registration;
- ship_classifier;
- ship_identification;
- ship_name;
- ship_operator;
- ship_owner;

— ship_type_description.

4.2.471.1 call_sign

The call_sign specifies the unique lifecycle identifier assigned to the ship by the flag_state for radio communication.

4.2.471.2 date_placed_in_service

The date_placed_in_service specifies the date when the ship first went into service. The date_placed_in_service need not be specified for a particular Ship_designation.

4.2.471.3 defined_for

The defined_for specifies a set of one to many ships for which the ship designation data are defined.

4.2.471.4 flag_state

The flag_state specifies the national authority with whom the ship is registered.

4.2.471.5 port_of_registration

The port_of_registration specifies the national home port of the ship. The port_of_registration lies within the jurisdiction of the flag_state.

4.2.471.6 ship_classifier

The ship_classifier specifies details of the classification society under which the ship is currently classed. The ship_classifier need not be specified for a particular Ship_designation.

4.2.471.7 ship_identification

The ship_identification specifies a general identifier unique to the ship, as text, as assigned during the classification process.

4.2.471.8 ship_name

The ship_name specifies the owner assigned name of the ship.

4.2.471.9 ship_operator

The ship_operator specifies details of the current operator of the ship. The ship_operator need not be specified for a particular Ship_designation.

4.2.471.10 ship_owner

The ship_owner specifies details of the current owner of the ship. The ship_owner need not be specified for a particular Ship_designation

4.2.471.11 ship_type_description

The `ship_type_description` specifies more details about the function of the ship and additional information about the cargo carried.

4.2.472 Ship_general_characteristics

A `Ship_general_characteristics` is a type of Definition (see 4.2.77) and specifies the concept for representation of data that are attributable to general characteristics of the ship.

4.2.473 Ship_operation_characteristics

A `Ship_operation` characteristic is a type of `Ship_general_characteristics` and specifies the operational mode of the ship.

The data associated with a `Ship_operation_characteristic` are the following:

- `defined_for`;
- `ship_operation_mode`.

4.2.473.1 defined_for

The `defined_for` specifies a set of one to many ships for which overall dimensions are defined.

4.2.473.2 ship_operation_mode

The `ship_operation_mode` specifies the ship operation condition.

The value of `Ship_operation_mode` shall be one of the following:

- `at_anchor`;
- `dry_dock`;
- `port_operation`;
- `steaming`;
- `user_defined_ship_operation_mode`.

4.2.473.2.1 at_anchor: the descriptor that specifies the ship to be at anchor.

4.2.473.2.2 dry_dock: the descriptor that specifies the ship to be at dry dock.

4.2.473.2.3 port_operation: the descriptor that specifies the ship is operating at the port.

4.2.473.2.4 steaming: the descriptor that specifies the ship is under normal operating condition at sea.

4.2.473.2.5 user_defined_ship_operation_mode: the descriptor, set by the user, that specifies the operation mode of the ship if different from other options.

4.2.474 Ship_overall_dimension

A `Ship_overall_dimension` specifies the maximum limits of the ship moulded form.

The data associated with `Ship_overall_dimensions` are the following:

- `defined_for`;

- stem_overhang;
- stern_overhang.

4.2.474.1 defined_for

The defined_for specifies a set of one to many ships for which overall dimensions are defined.

4.2.474.2 stem_overhang

The stem_overhang specifies the length from the forward perpendicular to the extreme forward end of ship moulded form.

4.2.474.3 stern_overhang

The stern_overhang specifies the length from the extreme aft end of the ship moulded form to the after perpendicular.

4.2.475 Ship_space

A Ship_space specifies the ship spaces/locations, within which the mechanical product is positioned.

The data associated with a Ship_space are the following:

- ship_space_name.

4.2.475.1 ship_space_name

The ship_space_name specifies the name used to identify a location within the ship.

The value of the ship_space_name shall be one of the following:

- deck;
- engine_room;
- machinery_room;
- user_defined_ship_space.

4.2.475.1.1 deck: the descriptor which specifies that the mechanical product is placed on the deck.

4.2.475.1.2 engine_room: the descriptor which specifies that the mechanical product is placed in the engine room.

4.2.475.1.3 machinery room: the descriptor which specifies that the mechanical product is placed in the machinery room.

4.2.475.1.4 user_defined_ship_space: the descriptor, set by the user, which specifies the ship compartment within which the mechanical product is located if different from the other options.

4.2.476 Ship_voyage

A Ship_voyage is a type of Definition (see 4.2.77) and specifies all the information about a ship voyage including route, port visits and corresponding schedule and delays.

The data associated with a Ship_voyage are the following:

- at_port;
- at_restricted_water;
- at_sea;
- at_shipyard;
- defined_for;
- voyage_delays;
- voyage_schedule.

4.2.476.1 at_port

The at_port specifies a set of zero to many Ship_at_port (see 4.2.467) that define all the ports visited by the ship along its route. There may be more than one at_port for a Ship_voyage.

4.2.476.2 at_restricted_water

The at_restricted_water specifies a set of zero to many Ship_at_restricted_water (see 4.2.468) that define all the restricted water areas through which the ship has travelled. There may be more than one at_restricted_water for a Ship_voyage.

4.2.476.3 at_sea

The at_sea specifies a set of zero to many Ship_at_sea (see 4.2.469) that define the route and schedule for the ship voyage in open sea or ocean. There may be more than one at_sea for a Ship_voyage

4.2.476.4 at_shipyard

The at_shipyard specifies a set of zero to many Ship_at_shipyard (see 4.2.470) that define all the shipyards visited by the ship along its journey. There may be more than one at_shipyard for a Ship_voyage.

4.2.476.5 defined_for

The defined_for specifies a set of one to many ships for which ship voyage is defined.

4.2.476.6 voyage_delays

The voyage_delays specifies time spent on a voyage in excess of planned time. The voyage_delays need not be specified for a particular Ship_voyage

4.2.476.7 voyage_schedule

The voyage_schedule specifies a Time_schedule (see 4.2.536) that the ship is expected to follow, or has actually followed, during the voyage. The voyage_schedule need not be specified for a particular Ship_voyage.

4.2.477 Shipyard

A Shipyard is a type of Item (see 4.2.253) and specifies the concept for defining a shipyard within the context of this part of ISO 10303.

The data associated with a Shipyard are the following:

- shipyard_name.

The shipyard_name specifies the name and description details of the shipyard.

4.2.478 Shipyard_designation

A Shipyard_designation is a type of Ship_general_characteristic (see 4.2.472) and specifies the identification given to the ship by the shipbuilder.

The data associated with a Shipyard_designation are the following:

- defined_for;
- role;
- shipyard;
- shipyard_new_building_id;
- shipyard_project_name.

4.2.478.1 defined_for

The defined_for specifies a set of one to many ships for which the shipyard designation has been defined.

4.2.478.2 role

The role specifies the contractual obligation the shipyard has in relation to the ship.

The value of Shipyard_role shall be one of the following:

- prime_design;
- prime_build;
- prime_repair;
- prime;
- subcontractor.

4.2.478.2.1 prime_design: the prime contractor, with contract responsibility for the design of the ship.

4.2.478.2.2 prime_build: the prime contractor, with contract responsibility for the manufacture of the ship.

4.2.478.2.3 prime_repair: the prime contractor, with contract responsibility for the repair of the ship.

4.2.478.2.4 prime: the prime contractor for the ship.

4.2.478.2.5 subcontractor: the subcontractor for the ship.

4.2.478.3 shipyard

The shipyard specifies the name and organisational details of the shipyard.

4.2.478.4 shipyard_new_building_id

The `shipyard_new_building_id` specifies an identifier for the ship that is assigned by the shipyard after an order has been confirmed.

4.2.478.5 shipyard_project_name

The `shipyard_project` name specifies an identifier for the ship that is assigned by the shipyard on receipt of an order, or tender, for a new ship.

4.2.479 Signal_conditioner

A `Signal_conditioner` is a type of `Control_equipment` (see 4.2.44) and specifies the concept for defining all the signal conditioners that need to be defined. A signal conditioner is used in control and measurements systems to improve or transform raw measured signals for later use.

4.2.480 Silencer

A `Silencer` is a type of `Mechanical_equipment` (see 4.2.310) and specifies the concept for defining all the silencers that need to be defined. A silencer is a device used to reduce or eliminate the sound made by discharging exhaust gas from the engine, by reducing the exhaust gas pressure waves.

4.2.481 Socket

A `Socket` is a type of `Electrical_connector` (see 4.2.121) and specifies the concept for all the electrical sockets that need to be defined. An electrical socket is the female connector into which an electric plug (see 4.2.364) is inserted.

4.2.482 Solid_chemical_property

A `Solid_chemical_property` is a type of `Material_chemical_property` (see 4.2.299) and specifies the chemical properties of the solid material.

The data associated with a `Solid_chemical_property` are the following:

— `defined_for`.

The `defined_for` specifies a set of one to many solid materials for which chemical properties are specified.

4.2.483 Solid_coupling

A `Solid_coupling` is a type of `Shaft_coupling` (see 4.2.454) and specifies the concept for defining all the solid couplings that need to be defined. A solid coupling is a nonflexible (rigid) connection between two shafts.

The data associated with a `Solid_coupling` are the following:

— `solid_coupling_type`.

4.2.483.1 solid_coupling_type

The solid_coupling_type specifies the type of the solid_coupling.

The value of solid_coupling_type shall be one of the following:

- flanged;
- muff;
- user_defined_type.

4.2.483.1.1 flanged: the descriptor that specifies that the solid coupling is realised by connecting the two flanged ends of the shafts directly by bolting.

4.2.483.1.2 muff: the descriptor that specifies that the solid coupling is realised by a sleeve type connection without any flange.

4.2.483.1.3 user_defined_type: the descriptor, set by the user, if the type of the solid coupling is different from the other options.

4.2.484 Solid_material

A Solid_material is a type of Material (see 4.2.298) and specifies the concept for all the solid materials and their properties that need to be defined.

The data associated with a Solid_material are the following:

- solid_type.

4.2.484.1 solid_type

The solid_type specifies the type of solid material.

The value for the solid_type shall be one of the following:

- coal;
- metal;
- user_defined_solid_type.

4.2.484.1.1 coal: the descriptor that specifies the solid material is coal that is used primarily as a solid fossil fuel.

4.2.484.1.2 metal: the descriptor that specifies the solid material is a metal.

4.2.484.1.3 user_defined_solid_type: the descriptor, set by the user, that specifies the type of solid material if different from the other options.

4.2.485 Solid_material_requirement

A Solid_material_requirement is a type of Material_requirement (see 4.2.304) and specifies the type and level of the solid material that is needed for the operation of a mechanical product and has to be satisfied by an external resource.

The data associated with a Solid_material_requirement are the following:

- mass;
- solid_material_details.

4.2.485.1 mass

The mass specifies the amount of solid material in terms of its mass.

4.2.485.2 solid_material_details

The solid_material_details specifies the type of the solid material that has to be provided by an external resource.

4.2.486 Solid_model

A Solid_model is a complete representation of the nominal shape of a product such that all points in the interior are connected. Any point can be classified as being inside, outside or on the boundary of a solid. It is used as defined in ISO 10303-41.

4.2.487 Solid_physical_property

A Solid_physical_property is a type of Material_physical_property (see 4.2.302) that specifies physical properties that are attributable to a solid material.

The data associated with a Solid_physical_property are the following:

- corrosion_fatigue_strength;
- defined_for;
- elongation;
- fatigue_strength;
- hardness;
- poisson_ratio;
- shear_modulus;
- stress_of_fracture;
- thermal_expansion_ratio;
- ultimate_tensile_stress;
- yield_point;
- youngs_modulus.

4.2.487.1 corrosion_fatigue_strength

The corrosion_fatigue_strength specifies the material fatigue strength under corrosion conditions.

4.2.487.2 defined_for

The defined_for specifies a set of one to many solid materials for which the properties are defined.

4.2.487.3 elongation

The elongation specifies the stretching characteristic of a solid material under tensile stress.

4.2.487.4 fatigue_strength

The `fatigue_strength` specifies the fatigue strength of a material which is the highest stress that a material can be expected to withstand for an infinite number of cycles without failure.

4.2.487.5 hardness

The `hardness` specifies a number indicating the relative hardness of a substance as determined by various hardness tests.

4.2.487.6 poisson_ratio

The `poisson_ratio` specifies the poisson ratio of the material which is the negative ratio between longitudinal and transversal strains.

4.2.487.7 shear_modulus

The `shear_modulus` specifies the material shear modulus which indicates the strength factor for the material under shear stress. The `shear_modulus` is a DERIVED attribute from `youngs_modulus` and `poisson_ratio`.

4.2.487.8 stress_of_fracture

The `stress_of_fracture` specifies the stress level beyond which the material will undergo fraction and loose coherence.

4.2.487.9 thermal_expansion_ratio

The `thermal_expansion_ratio` specifies the linear expansion caused by a unit change of material temperature level.

4.2.487.10 ultimate_tensile_stress

The `ultimate_tensile_stress` specifies the material's ultimate tensile stress which is the highest tensile stress that a material can withstand before it fractures or fails.

4.2.487.11 yield_point

The `yield_point` specifies the yield point of the material. The yield point defines the limit to elastic deformation beyond which the material undergoes plastic deformation.

4.2.487.12 youngs_modulus

The `youngs_modulus` specifies the material youngs modulus of elasticity which is the ratio between stress and strain in the elastic region (Hook's law).

4.2.488 Spare_part

A `Spare_part` is a type of `Task_resource` (see 4.2.523) that specifies the concept for collecting information on spare parts needed for a task.

The data associated with a Spare_part are the following:

- spare_parts_list.

The spare_parts_list provides a list of all, if any, the required spare parts. There may be more than one spare_parts_list for a Spare_part.

4.2.489 Spare_parts_requirement

A Spare_parts_requirement is a type of External_resources_requirement (see 4.2.147) and specifies the level and details of the spare parts that is needed for the operation of a mechanical product. The spare parts will be specified in text format.

4.2.490 Specific_fuel_consumption

A Specific_fuel_consumption is a type of Measure_with_unit (see 4.2.305) where the physical quantity is the rate at which fuel is consumed to produce a unit of power or thrust. The specific fuel consumption is a measure of thermodynamic performance of combustion engines.

A data associated with a Specific_fuel_consumption are the following:

- specific_fuel_consumption_unit.

The specific_fuel_consumption_unit specifies all the units that can be used for quantifying the specific fuel consumption.

4.2.491 Speed

A Speed is a type of Measure_with_unit (see 4.2.305) where the physical quantity is linear speed.

The data associated with a Speed are the following:

- speed_unit.

The speed_unit specifies all the units in which linear speed is measured.

4.2.492 Speed_sensor

A Speed_sensor is a type of Sensor (see 4.2.448) and specifies the concept for defining all the sensors that are used for measuring either rotational or linear speed.

4.2.493 Starting_system

A Starting_system is a type of Mechanical_system (see 4.2.326) and specifies the concept for defining all the starting systems that need to be defined. The starting system is used to set the machinery, such as diesel engine, into motion, until it can sustain its motion via its internal processes.

The data associated with a Starting_system are the following:

- starting_system_type;

4.2.493.1 starting_system_type

The starting_system_type specifies the type of the starting system.

The value of starting_system_type shall be one of the following:

- electric;
- manual;
- pneumatic.

4.2.493.1.1 electric: the descriptor that specifies that the starting system uses electric energy for its operation.

4.2.493.1.2 manual: the descriptor that specifies that the starting system uses manual power for its operation.

4.2.493.1.3 pneumatic: the descriptor that specifies that the starting system uses pneumatic pressure for its operation.

4.2.494 Steam_generation_system

A Steam_generation_system is a type of Mechanical_system (see 4.2.326) that specifies the high level concept for all the ship's steam generation systems that need to be defined.

The data associated with a Steam_generation_system are the following:

- type_of.

The type_of specifies, as text, the type of steam generation systems.

4.2.495 Steam_power_plant

A Steam_power_plant is a type of Electric_power_generation_system (see 4.2.118) and specifies the concept for defining all the electric power plants that use steam turbine for generating electrical energy. In addition to steam turbine, steam generator (boiler), boil feed pump, and steam condenser are amongst the main parts of a steam power plant.

4.2.496 Steering_control_mechanism

A Steering_control_mechanism is a type of Mechanical_system (see 4.2.326) and specifies the concept for defining all the steering control mechanism that need to be defined. A steering control mechanism is used in conjunction with propulsors (see 3.10.80) and is used to alter the direction of thrust generated by a propulsor.

4.2.497 Steering_system

A Steering_system is a type of Mechanical_system (see 4.2.326) and specifies the concept for defining all the steering systems that need to be defined. A steering system is part of a ship manoeuvring system and provides the means for altering the direction of propulsor thrust to control ship direction of movement.

4.2.498 Stock_definition

A Stock_definition is a type of Procurement_definition (see 4.2.375) and specifies the data associated with stocking of mechanical products.

The data associated with a Stock_definition are the following:

- defined_for;
- quantity_in_stock;
- quantity_max_recommended_stock;
- quantity_min_recommended_stock.

4.2.498.1 defined_for

The defined_for specifies a set of one to many mechanical products for which stocking definition is specified.

4.2.498.2 quantity_in_stock

The quantity_in_stock specifies the number of the selected mechanical products kept currently in stock.

4.2.498.3 quantity_max_recommended_stock

The quantity_max_recommended_stock specifies the maximum number of selected mechanical products recommended to be kept in stock.

4.2.498.4 quantity_min_recommended_stock

The quantity_min_recommended_stock specifies the minimum number of the selected mechanical products recommended to be kept in stock.

4.2.499 Stress

A Stress is a type of Measure_with_unit (see 4.2.305) where the physical quantity is the stress within a material.

The data associated with a Stress are the following:

- stress_unit.

The stress_unit specifies all the units in which the physical quantity of stress is measured.

4.2.500 String_value

The String_value specifies that the property value is of type string (text).

The data associated with a String_value are the following:

- the_value.

The the_value specifies the value of the property in text format.

4.2.501 Structural_connection

A Structural_connection is a type of Mechanical_product_connection (see 4.2.317) that specifies the connection (see 3.10.25) between a mechanical product and a ship structure.

The data associated with a Structural_connection are the following:

- connection_type.

4.2.501.1 connection_type

A connection_type specifies the type of the structural connection.

The value of a connection_type shall be one of the following:

- component_mounting;
- equipment_mounting;
- equipment_support;
- insulation_attachment;
- pipe_support;
- user_defined_structural_connection.

4.2.501.1.1 component_mounting: the descriptor which specifies that the structural connection is of type component mounting.

4.2.501.1.2 equipment_mounting: the descriptor which specifies that the structural connection is of type equipment mounting.

4.2.501.1.3 equipment_support: the descriptor which specifies that the structural connection is of type equipment support.

4.2.501.1.4 insulation_attachment: the descriptor which specifies that the structural connection is of type insulation attachment.

4.2.501.1.5 pipe_support: the descriptor which specifies that the structural connection is of type pipe support.

4.2.501.1.6 user_defined_structural_connection: the descriptor, set by the user, which specifies the type of structural connection if different from the other options.

4.2.502 Structural_connection_general_characteristic

A Structural_connection_general_characteristic is a type of Product_connection_general_characteristic (see 4.2.381) and specifies the structural connection's overall specifications and characteristics.

The data associated with an Structural_connection_general_characteristic are the following:

- defined_for.

The defined_for specifies a set of one to many structural connections for which general characteristics are defined.

4.2.503 Structural_connector

A Structural_connector is a type of Connector_component (see 4.2.41) and specifies the concept for data representation of all types of structural connectors (see 3.10.26) that need to be defined. Within this part of ISO 10303 either a Bedplate (see 4.2.19) or a Hinge (see 4.2.245).

4.2.504 Structural_item

A Structural_item is a type of Connecting_component (see 4.2.39) and specifies the concept for all the structural items that need to be defined. A structural item is normally part of a ship structure or equipment casing or equipment block and serves as either a connector component (see 3.10.27) or a connecting component (see 3.10.24).

4.2.505 Supplier_BSU

A Supplier_BSU is a type of BSU (see 4.2.24) and specifies the identification information for referencing a supplier of an ISO 13584 compliant data library.

4.2.506 Surface_tension

A Surface_tension is a type of Measure_with_unit (see 4.2.305) where the physical quantity is surface tension of a liquid.

The data associated with a Surface_tension are the following:

- surface_tension_unit.

The surface_tension_unit specifies all the units in which the physical quantity of force per length is measured.

4.2.507 Survey_inspection_task

A Survey_inspection_task is a type of Task (see 4.2.511) and specifies the concept for representation of data that are attributable to a survey/inspection task.

The data associated with a Survey_inspection_task are the following:

- survey_inspection_type.

4.2.507.1 survey_inspection_type

The survey_inspection_type specifies the type of survey/inspection task that needs to be carried out.

The value of a survey_inspection_type shall be one of the following:

- class_survey;
- flag_state_inspection;
- shop_inspection;
- user_defined.

4.2.507.1.1 class_survey: the descriptor that specifies that the task is surveyors required by classification society rules.

4.2.507.1.2 flag_state_inspection: the descriptor that specifies that the task is inspection as required by the flag state.

4.2.507.1.3 shop_inspection: the descriptor that specifies that the task is inspection of manufacturing and testing processes as carried out in the manufacturing site.

4.2.507.1.4 user_defined: the descriptor, set by the user, that specifies the type of survey inspection if different from the other options.

4.2.508 Switch_board

A Switch_board is a type of Electrical_equipment (see 4.2.123) and specifies the concept for defining all the switch boards that need to be defined. A switch board is a large panel of assembled switches, circuit breakers, meters, fuses and terminals that are primary to the operation of an electronic or an electrical equipment.

4.2.509 System_composition

A System_composition is a type of Product_composition (see 4.2.379) and specifies the list of mechanical products that together are part of the system.

The data associated with a System_composition are the following:

— defined_for.

The defined_for specifies a set of one to many systems for which the composition data are defined.

4.2.510 Tank

A Tank is a type of Piping_equipment (see 4.2.357) and specifies the concept for defining all the tanks that need to be defined. A tank is any large vessel, closed or open, used for holding a fluid such as water, low pressure gas, gasoline, or other fuel.

4.2.511 Task

A Task is a type of Item (see 4.2.253) that specifies the high level concept for data representation for all various tasks (see 3.10.97) and activities that need to be defined. Within this part of ISO 10303 each Task is either an Analysis_task (see 4.2.7), a Design_task (see 4.2.84), a Maintenance_task (see 4.2.290), an Operation_task (see 4.2.340), a Survey_inspection_task (see 4.2.507) or a Test_task (see 4.2.530)

The data associated with a Task are the following:

— task_number.

The task_number specifies a label for identification of the task.

4.2.512 Task_approval

A Task_approval is a type of Approval_event (see 4.2.13) that specifies task-related data on approval and authorisation.

4.2.513 Task_composition

A Task_composition is a type of Task_definition (see 4.2.516) that specifies all the sub-tasks that together form this task.

The data associated with a Task_composition are the following:

- composed_of.

The task_composed_of specifies all the tasks that together form this task. There may be more than one composed_of for a Task_composition.

4.2.514 Task_configuration

A Task_configuration is a type of Task_definition (see 4.2.516) that specifies all the data relating to the configuration (see 3.10.23) of a task (see 3.10.97).

The data associated with a Task_configuration are the following:

- task_approval;
- task_authorisation;
- task_authority;
- task_location;
- task_reason;
- task_request_details;
- task_status.

4.2.514.1 task_approval

The task_approval specifies information on approval of a task in the form of event and approval data (see 3.10.41).

4.2.514.2 task_authorisation

The task_authorisation specifies information on authorisation of a task in the form of event and approval data (see 3.10.41).

4.2.514.3 task_authority

The task_authority specifies the organisation that has given the authority for a task to be carried out.

4.2.514.4 task_location

The task_location specifies the place where the task is performed. The task_location need not be specified for a particular Task_configuration.

The value of task_location shall be one of the following:

- in_shipyard;
- in_supplier_premises;
- on_board_ship;
- user_defined_location.

4.2.514.4.1 in_shipyard: the descriptor which specifies that the task was or will be performed at a shipyard.

4.2.514.4.2 in_supplier_premises: the descriptor which specifies that the task is to be performed at the supplier's premises.

4.2.514.4.3 on_board_ship: the descriptor which specifies that the task was or will be performed on board ship.

4.2.514.4.4 user_defined_location: the descriptor, set by the user, which specifies the location where the task was or will be executed if different from the other options.

4.2.514.5 task_reason

The task_reason specifies the reasons, as text, for doing the task.

4.2.514.6 task_request_detail

The task_request_detail provides detailed information regarding the request procedure for a particular task.

4.2.514.7 task_status

The task_status specifies the status of a task within its life cycle.

The value of task_status shall be one of the following:

- completed;
- concept;
- executed;
- planned;
- under_execution;
- under_planning.

4.2.514.7.1 completed: the descriptor which specifies that the task has been fully completed without any need for further action.

4.2.514.7.2 concept: the descriptor which specifies that the task is at the concept stage.

4.2.514.7.3 executed: the descriptor which specifies that the task has been executed.

4.2.514.7.4 planned: the descriptor which specifies that the task planning is complete but not executed.

4.2.514.7.5 under_execution: the descriptor which specifies that the task is at the execution stage.

4.2.514.7.6 under_planning: the descriptor which specifies that the task is at the planning stage.

4.2.515 Task_cost

A Task_cost is a type of Task_definition (see 4.2.516) and specifies the concept for defining all the cost data that need to be defined in relation to a particular task, such as maintenance or survey.

The data associated with a Task_cost are the following:

- task_cost_details.

The task_cost_details specify, as text, the details of the cost incurred.

4.2.516 Task_definition

A Task_definition is a type of definition (see 4.2.77) and is the supertype for all kinds of task-related definitions. The Task_definition specifies the high level concept for relating definitions to a task (see 3.10.97). Within this part of ISO 10303 each Task_definition is either a Task_composition (see 4.2.513), a Task_configuration (see 4.2.514), a Task_cost (see 4.2.515), a Task_participation (see 4.2.518), a Task_planning_characteristic (see 4.2.519), a Task_resource (see 4.2.523), a Task_results (see 4.2.524), a Task_schedule (see 4.2.525), or a Task_time (see 4.2.526).

The data associated with a Task_definition are the following:

- defined_for.

The defined_for specifies a set of one to many tasks for which definitions are provided.

4.2.517 Task_other_resource

A Task_other_resource is a type of Task_resource (see 4.2.523) that specifies all required or used resources for a task other than those already specified in Human_resource (see 4.2.247), Spare_part (see 4.2.488) and Tool (see 4.2.538).

The data associated with a Task_other_resource are the following:

- task_other_resources.

The task_other_resources attribute specifies, as text, all the relevant information relating to the use of other resources.

4.2.518 Task_participation

A Task_participation is a type of Task_definition (see 4.2.516) and specifies the concept for defining the case when one task is defined as a part of another task.

The data associated with a Task_participation are the following:

- task_is_part_of.

The task_is_part_of specifies another Task (see 4.2.511) within which the current task needs to be performed.

4.2.519 Task_planning_characteristic

A `Task_planning_characteristic` is a type of `Task_definition` (see 4.2.516) and specifies the concept for defining all the data that need to be defined for planning a task.

The data associated with a `Task_planning_characteristic` are the following:

- `required_man_hour`;
- `task_duration`;
- `task_float`;
- `task_schedule_constraint`;
- `task_alt_interval`;
- `task_interval`.

4.2.519.1 `required_man_hour`

The `required_man_hour` specifies the required man time for carrying out a particular task. The `required_man_hour` need not be specified for a particular `Task_planning_characteristic`.

4.2.519.2 `task_duration`

The `task_duration` specifies the planned time for carrying out a particular task. The `task_duration` need not be specified for a particular `Task_planning_characteristic`.

4.2.519.3 `task_float`

The `task_float` specifies the time duration by which a task can be delayed against a prescribed schedule. The `task_float` need not be specified for a particular `Task_planning_characteristic`.

4.2.519.4 `task_schedule_constraint`

The `task_schedule_constraint` specifies, as text, details of the constraints that need to be taken into account while carrying out a particular task. The `task_schedule_constraint` need not be specified for a particular `Task_planning_characteristic`.

4.2.519.5 `task_alt_interval`

The `task_alt_interval` specifies an alternative interval other than `task_interval` that can be used for task planning. A `task_alt_interval` is either a `Counter` (see 4.2.48), a `Time` (see 4.2.534) or a `non_periodic_interval_type` (see 4.2.335). The `task_alt_interval` need not be specified for a particular `Task_planning_characteristic`.

4.2.519.6 `task_interval`

The `task_interval` specifies an interval type and value according to which the task should be planned or performed. A `task_interval` is either a `Counter` (see 4.2.48), a `Time` (see 4.2.534) or a `non_periodic_interval_type` (see 4.2.335).

4.2.520 `Task_procedure`

A `Task_procedure` is a type of `Task_definition` (see 4.2.516) that specifies the procedures according to which a task (see 3.10.97) needs to be carried out.

The data associated with a Task_procedure are the following:

- procedure_description;
- task_procedures.

4.2.520.1 procedure_description

The procedure_description specifies, as text, what procedure should be applied when carrying out a task.

4.2.520.2 task_procedures

The task_procedures attribute specifies and references a set of zero, one or many documents that contain detailed procedures for carrying out the task. There may be more than one task_procedures for a Task_procedure.

4.2.521 Task_relationship

A Task_relationship specifies the concept for relating two tasks together.

The data associated with a Task_relationship are the following:

- description;
- major_aspect_of_relationship;
- related_task;
- this_task.

4.2.521.1 description

The description specifies a textual description of the relationship. The description need not be specified for a particular Task_relationship.

4.2.521.2 major_aspect_of_relationship

The major_aspect_of_relationship specifies the important aspect of the relationship between a task and its related task. The major_aspect_of_relationship need not be specified for a particular Task_relationship.

The value of major_aspect_of_relationship shall be one of the following:

- concurrent;
- predecessor;
- successor;
- user_defined_relationship.

4.2.521.2.1 concurrent: the descriptor which specifies that this_task and the related_task should be carried out concurrently.

4.2.521.2.2 predecessor: the descriptor which specifies that this_task should be completed after the related_task is initiated.

4.2.521.2.3 successor: the descriptor which specifies that this_task should be carried out before the related_task.

4.2.521.2.4 user_defined_relationship: the descriptor, set by the user, which specifies the relationship between two tasks if different from the other options.

4.2.521.3 related_task

The related_task attribute specifies the task which is related to this_task.

4.2.521.4 this_task

The this_task attribute specifies a task for which a related_task is specified.

4.2.522 Task_request_detail

A Task_request_detail specifies details of the request made to carry out a particular task.

The data associated with a Task_request_detail are the following:

- request_description;
- request_number.

4.2.522.1 request_description

The request_description describes, as text, details of the request related to a particular task.

4.2.522.2 request_number

The request_number specifies, as text, the purchase order number.

4.2.523 Task_resource

A Task_resource is a type of Task_definition (see 4.2.516) and specifies the high level concept for defining all the resources that are needed to perform a task. Within this part of ISO 10303 each Task_resource is either a Human_resource (see 4.2.247), a Spare_part (see 4.2.488), a Task_other_resource (see 4.2.516) or a Tool (see 4.2.538).

4.2.524 Task_result

A Task_result is a type of Task_definition (see 4.2.516) and specifies the results of a task.

The data associated with a Task_result are the following:

- results_as_report;
- results_in_summary.

4.2.524.1 results_as_report

The results_as_report specifies and references a set of documents that contain full results of a task. There may be more than one results_as_report for a Task_result.

4.2.524.2 results_in_summary

The results_in_summary specifies, as text, the summary results of a task.

4.2.525 Task_schedule

A Task_schedule is a type of Task_definition (see 4.2.516) and Time_schedule (see 4.2.536) which specifies the schedule for a task.

4.2.526 Task_time

A Task_time is a type of Task_definition (see 4.2.516) and specifies the time-related data, such as the time it takes to perform the job, for a task.

The data associated with a Task_time are the following:

- logistic_delay;
- time_to_task.

4.2.526.1 logistic_delay

The logistic_delay specifies a set of zero to many time periods representing the delays that occurred in carrying out the task due to logistical problems. There may be more than one logistic_delay for a Task_time.

4.2.526.2 time_to_task

The time_to_task specifies a time period that is planned to take or has actually taken to perform the task.

4.2.527 Temperature

A Temperature is a type of Measure_with_unit (see 4.2.305) where the physical quantity is temperature as defined in ISO 31 (clause 2).

The data associated with a Temperature are the following:

- temperature_unit.

The temperature_unit specifies all the units in which the temperature is measured.

4.2.528 Temperature_sensor

A Temperature_sensor is a type of Sensor (see 4.2.448) and specifies the concept for defining all the sensors that are used for measuring temperature.

4.2.529 Tension_rod

A Tension_rod is a type of Mechanical_component (see 4.2.306) and specifies the concept for all the tension rods that need to be defined. A tension rod is a structural component that is subject to tensile stress only. In diesel engines, a tension rod is normally fitted to large, low speed, two-stroke engines.

It is in the form of long vertical studs extending from bedplate to the top of the cylinder block and transmits the main gas loads from the cylinder head to the bedplate.

4.2.530 Test_task

A Test_task is a type of Task (see 4.2.511) and specifies the concept for defining the tasks that involve testing or measurement of either functional or physical aspects of an equipment.

The data associated with a Test_task are the following:

- test_type.

4.2.530.1 test_type

The test_type specifies the type of the test that needs to be carried out.

The value of test_type shall be one of the following:

- hydrostatic;
- performance;
- sound_pressure_level;
- user_defined.

4.2.530.1.1 hydrostatic: the descriptor that specifies that the test to be carried out involves mainly the use of hydraulic system such as pressure testing and leakage testing of process tanks and vessels.

4.2.530.1.2 performance: the descriptor that specifies that the test to be carried out involves mainly the functional performance measurement of the equipment.

4.2.530.1.3 sound_pressure_level: the descriptor that specifies that the task to be carried out involves mainly the measurement of sound pressure level for noise.

4.2.530.1.4 user_defined: the descriptor, set by the user, that specifies the test type if different from the other options.

4.2.531 Text

A Text application object is used to assign a character text in order to describe something. It is used as defined in ISO 10303-41.

4.2.532 The_value

The The_value specifies which basic value type is to be used to describe the property.

The data associated with a The_value are the following:

- the_value.

The the_value selects the type of the value assigned to the property.

4.2.533 Thermal_conductivity

A `Thermal_conductivity` is a type of `Measure_with_unit` (see 4.2.305) where the physical quantity is thermal conductivity.

The data associated with a `Thermal_conductivity` are the following:

- `thermal_conductivity_unit`.

The `thermal_conductivity_unit` specifies all the units in which the physical quantity of thermal conductivity is measured.

4.2.534 Time

A `Time` is a type of `Measure_with_unit` (see 4.2.305) where the physical quantity is time as defined in ISO 31 (clause 2).

The data associated with a `Time` are the following:

- `time_unit`.

The `time_unit` specifies all the units in which the duration of periods is measured

4.2.535 Time_period

A `Time_period` specifies a time period in terms of its start and end dates.

The data associated with a `Time_period` are the following:

- `end_date`;
- `start_date`.

4.2.535.1 end_date

The `end_date` specifies the end date for the time period.

4.2.535.2 start_date

The `start_date` specifies the start date for the time period.

4.2.536 Time_schedule

A `Time_schedule` is a type of `Time_period` (see 4.2.535) and specifies a schedule on a calendar basis.

4.2.537 Tolerance

A `Tolerance` is a type of `Geometric_definition` (see 4.2.225) that provide the high level concept for all the definitions attributable to geometric tolerances of a mechanical product.

The data associated with a `Tolerance` are the following:

- `clearances`;
- `defined_for`;
- `tolerances`.

4.2.537.1 clearances

The clearances specify, as text, the space that should be left free between components of mechanical product. The clearances need not be specified for a particular Tolerance.

4.2.537.2 defined_for

The defined_for specifies a set of one to many mechanical products for which tolerance data are defined.

4.2.537.3 tolerances

The tolerances specifies all the descriptive aspects of product tolerances in text format. Manufacturing and other tolerances will only be specified in text format in this part of ISO 10303.

4.2.538 Tool

A Tool is a type of Task_resource (see 4.2.523) that specifies the concept for collecting information on tools needed to carry out a task.

The data associated with a Tool are the following:

— tools_list.

The tools_list specifies a set of all the required tools. There may be more than one tools_list for a Tool.

4.2.539 Torque

A Torque is a type of Measure_with_unit (see 4.2.305) where the physical quantity is Torque.

The data associated with a Torque are the following:

— torque_unit.

The torque_unit specifies all the units for torque.

4.2.540 Torque_sensor

A Torque_sensor is a type of Sensor (see 4.2.448) and specifies the concept for defining all the sensors that are used for measuring torque.

4.2.541 Transformer

A Transformer is a type of Electrical_equipment (see 4.2.123) and specifies the concept for all the transformers that need to be defined. A transformer is a device that reduces or increases the voltage and current of the input electricity, while keeping the same frequency.

The data associated with a Transformer are the following:

— transformer_type.

The transformer_type specifies, as text, the type of the transformer.

4.2.542 Tunnel

A Tunnel is a type of Piping_component (see 4.2.351) and specifies the concept for all the piping system tunnels that need to be defined.

The data associated with a Tunnel are the following:

— the_type.

The the_type specifies, as text, the type of the tunnel.

4.2.543 Turning_gear

A Turning_gear is a type of Rotating_component (see 4.2.421) and specifies the concept for all the turning gears that need to be defined. A turning gear is a gear drive unit connected to the machinery at an appropriate position (normally gear box or flywheel) via a clutch to rotate the engine slowly for the purpose of accurate positioning of the engine for maintenance, warming up procedures, cooling down procedures, gas purging procedures and/or testing/measurement procedure.

The data associated with a Turning_gear are the following:

— the_type.

The the_type specifies, as text, the type of the turning gear.

4.2.544 Value_list

The Value_list specifies a list of property values.

The data associated with a Value_list are the following:

— values.

The values specify a list of The_value (see 4.2.532), listing all property values for the mechanical product. There may be more than one values for a Value_list.

4.2.545 Valve

A Valve is a type of Piping_equipment (see 4.2.357) and specifies the concept for all the valves that need to be defined. A valve is a device that allows, halts or regulates the passage of a fluid in a piping system.

The data associated with a Valve are the following:

— valve_type.

4.2.545.1 valve_type

The valve_type specifies the type of the valve.

The value of valve_type shall be one of the following:

- ball_valve;
- butterfly_valve;
- check_valve;
- diaphragm_valve;
- gate_valve;
- globe_valve,
- plug_valve;
- relief_valve;
- solenoid_valve;
- user_defined_valve_type.

4.2.545.1.1 ball valve: the descriptor that specifies that the valve is of type ball valve. This type uses a ball, held against a cup-shaped seat having a circular opening of smaller diameter than the ball, to control the flow.

4.2.545.1.2 butterfly_valve: the descriptor that specifies that the valve is of type butterfly valve. This type uses a circular disk on hinges to control the flow.

4.2.545.1.3 check_valve: the descriptor that specifies that the valve is of type check valve. This type allows fluid to flow in only one direction.

4.2.545.1.4 diaphragm_valve: the descriptor that specifies that the valve is of type diaphragm. This type employs a diaphragm as the open-close element.

4.2.545.1.5 gate_valve: the descriptor that specifies that the valve is of type gate valve. This type uses a flat or wedge-shaped gate that can be lowered or raised to control the straight-through flow of a fluid.

4.2.545.1.6 globe_valve: the descriptor that specifies that the valve is of type globe valve. To regulate fluid flow this type uses a circular metal disk or ball that fits into the seating of the pipe and is moved by a threaded spindle.

4.2.545.1.7 plug_valve: the descriptor that specifies that the valve is of type plug valve. This type uses a plug that rotates 90° to open or close an area, allowing fluid to flow.

4.2.545.1.8 solenoid_valve: the descriptor that specifies that the valve is of type solenoid valve. This type uses actuation by the magnetic field produced in a solenoid to control the flow of gas or fluid in a pipe.

4.2.545.1.9 user_defined_valve_type: the descriptor, set by the user, that specifies the type of valve if different from the other options.

4.2.546 Valve_cage

A Valve_cage is a type of Mechanical_component (see 4.2.306) and specifies the concept for all the valve cages that need to be defined. A valve cage is an enclosing structure within a reciprocating engine that houses and combines all of the components of a valve, which can be removed from its location as a complete unit.

4.2.547 Vector

A Vector defines a vector in terms of the direction and the magnitude of the vector. It is used as defined in ISO 10303-42.

4.2.548 Vibration_characteristic

A Vibration_characteristic specifies the properties of the main vibration modes such as torsional and axial vibration.

The data associated with a Vibration_characteristic are the following:

- axial_vibration_properties;
- defined_for;
- torsional_vibration_properties;
- vibration_analysis_parameters.

4.2.548.1 axial_vibration_properties

The axial_vibration_properties specifies the stiffness and damping coefficient characteristics for the shaft axial vibrations.

4.2.548.2 defined_for

The defined_for specifies a set of one to many shafts for which vibration properties are defined.

4.2.548.3 torsional_vibration_properties

The torsional_vibration_properties specifies the stiffness and damping coefficient characteristics for the shaft torsional vibrations.

4.2.548.4 vibration_analysis_parameters

The vibration_analysis_parameters specifies, as text, the parameters used for vibration analysis.

4.2.549 Vibration_properties

A Vibration_properties specifies the properties of the shaft that are used to estimate its level of vibrations due to the prevailing dynamic forces.

The data associated with a Vibration_properties are the following:

- stiffness;
- damping_coefficient.

4.2.549.1 stiffness

The stiffness specifies the value of the shaft rotational stiffness.

4.2.549.2 damping_coefficient

The damping_coefficient specifies the value of the shaft rotational damping coefficient.

4.2.550 Viscosity

A Viscosity is a type of Measure_with_unit (see 4.2.305) where the physical quantity is kinematic viscosity of the fluid.

The data associated with a Viscosity are the following:

— viscosity_unit.

The viscosity_unit specifies all the units in which the physical quantity of area per time is measured.

4.2.551 Voltage

A Voltage is a type of Measure_with_unit (see 4.2.305) where the physical quantity is the voltage.

The data associated with a Voltage are the following:

— voltage_unit.

The voltage_unit specifies all the engineering units which can be used for voltage.

4.2.552 Volume_flow

A Volume_flow is a type of Measure_with_unit (see 4.2.305) where the physical quantity is the volume flow.

The data associated with a Volume_flow are the following:

— volume_flow_unit.

The volume_flow_unit specifies all the engineering units which can be used for volume flow.

4.2.553 Water_jet_propulsor

A Water_jet_propulsor is a type of Mechanical_system (see 4.2.326) and specifies the concept for defining all the waterjet propulsors that need to be defined. A waterjet propulsor is a machine which takes in water by means of a suitable inlet and ducting system and accelerates the mass of water using an impeller and nozzle to form a jet propulsion system.

4.2.554 Welded_end

A Welded_end is a type of Electrical_connector (see 4.2.121) and specifies the concept for defining all the electrical ends that are designed for connection by welding.

4.3 Application Assertions

This subclause specifies the application assertions for the ship mechanical systems application protocol. Application assertions specify the relationships between application objects, the cardinality of relationships, and the rules required for the integrity and validity of the application objects and UoFs. The application assertions and their definitions are given below.

4.3.1 Crane_composition to Crane

Each Crane_composition refers to a set of one or many Cranes. A set of Cranes defines the defined_for for Crane_composition.

4.3.2 Crane_design_characteristic to Crane

Each Crane_design_characteristic refers to a set of one or many Cranes. A set of Cranes defines the defined_for for Crane_design_characteristic.

4.3.3 Crane_general_characteristic to Crane

Each Crane_general_characteristic refers to a set of one or many Cranes. A set of Cranes defines the defined_for for Crane_general_characteristic.

4.3.4 Crane_load_characteristic to Crane

Each Crane_load_characteristic refers to a set of one or many Cranes. A set of Cranes defines the defined_for for Crane_load_characteristic.

4.3.5 Crane_overall_dimension to Crane

Each Crane_overall_dimension refers to a set of one or many Cranes. A set of Cranes defines the defined_for for Crane_overall_dimension.

4.3.6 Definition to Definable_object

Each Definition refers to a set of one or many Definable_objects. A set of Definable_objects defines the defined_for for Definition.

4.3.7 Design_characteristic to Mechanical_product

Each Design_characteristic refers to a set of one or many Mechanical_products. A set of Mechanical_products defines the defined_for for Design_characteristic.

4.3.8 Diesel_engine_design_characteristic to Diesel_engine

Each Diesel_engine_general_characteristic refers to a set of one or many Diesel_engines. A set of Diesel_engines defines the defined_for for Diesel_engine_design_characteristic.

4.3.9 Diesel_engine_general_characteristic to Diesel_engine

Each Diesel_engine_general_characteristic refers to a set of one or many Diesel_engines. A set of Diesel_engines defines the defined_for for Diesel_engine_general_characteristic.

4.3.10 Diesel_engine_operational_characteristic to Diesel_engine

Each Diesel_engine_operational_characteristic refers to a set of one or many Diesel_engines. A set of Diesel_engines defines the defined_for for Diesel_engine_operational_characteristic.

4.3.11 Equipment_identification to Mechanical_product_equipment

Each Equipment_identification refers to a set of one or many Mechanical_product_equipment. A set of Mechanical_product_equipment defines the defined_for for Equipment_identification.

4.3.12 Liquid_physical_property to Liquid_material

Each Liquid_physical_property refers to a set of one or many Liquid_material. A set of Liquid_material defines the defined_for for Liquid_physical_property.

4.3.13 Machinery_general_characteristic to Machinery

Each Machinery_general_characteristic refers to a set of one or many Machinery. A set of Machinery defines the defined_for for Machinery_general_characteristic.

4.3.14 Machinery_performance_data to Ambient_condition

Each Machinery_performance_data refers to exactly one Ambient_condition. Each Ambient_condition defines the ambient_condition for Machinery_performance_data.

4.3.15 Machinery_performance_data to Power

Each Machinery_performance_data refers to exactly one Power. Each Power defines the power for Machinery_performance_data.

4.3.16 Machinery_performance_data to Rotational_speed

Each Machinery_performance_data refers to exactly one Rotational_speed. Each Rotational_speed defines the rotational_speed for Machinery_performance_data.

4.3.17 Maintenance_configuration_data to Maintenance_task

Each Maintenance_configuration_data refers to a set of one or many Maintenance_tasks. A set of Maintenance_tasks defines the defined_for for Maintenance_configuration_data.

4.3.18 Maintenance_procedure to Maintenance_task

Each Maintenance_procedure refers to a set of one or many Maintenance_tasks. A set of Maintenance_tasks defines the defined_for for Maintenance_procedure.

4.3.19 Maintenance_result to Maintenance_task

Each Maintenance_result refers to a set of one or many Maintenance_tasks. A set of Maintenance_tasks defines the defined_for for Maintenance_result.

4.3.20 Maintenance_schedule to Maintenance_task

Each Maintenance_schedule refers to a set of one or many Maintenance_tasks. A set of Maintenance_tasks defines the defined_for for Maintenance_schedule.

4.3.21 Maintenance_spare_part to Maintenance_task

Each Maintenance_spare_part refers to a set of one or many Maintenance_tasks. A set of Maintenance_tasks defines the defined_for for Maintenance_spare_part.

4.3.22 Maintenance_tool to Maintenance_task

Each Maintenance_tool refers to a set of one or many Maintenance_tasks. A set of Maintenance_tasks defines the defined_for for Maintenance_tool.

4.3.23 Mass_weight_inertia to Mechanical_product

Each Mass_weight_inertia refers to a set of one or many Mechanical_products. A set of Mechanical_products defines the defined_for for Mass_weight_inertia .

4.3.24 Mechanical_product_drawing to Mechanical_product

Each Mechanical_product_drawing refers to a set of one or many Mechanical_products. A set of Mechanical_products defines the defined_for for Mechanical_product_drawing.

4.3.25 Mechanical_product_general_characteristic to Mechanical_product

Each Mechanical_product_general_characteristic refers to a set of one or many Mechanical_products. A set of Mechanical_products defines the defined_for for Mechanical_product_general_characteristic.

4.3.26 Overall_dimension to Mechanical_product

Each Overall_dimension refers to a set of one or many Mechanical_products. A set of Mechanical_products defines the defined_for for Overall_dimension.

4.3.27 Product_assemblage to Mechanical_product

Each Product_assemblage refers to a set of one or many Mechanical_products. A set of Mechanical_products defines the defined_for for Product_assemblage.

4.3.28 Product_composition to Mechanical_product

Each Product_composition refers to a set of one or many Mechanical_products. A set of Mechanical_products defines the defined_for for Product_composition .

4.3.29 Product_connectivity to Mechanical_product

Each Product_connectivity refers to a set of one or many Mechanical_products. A set of Mechanical_products defines the defined_for for Product_connectivity.

4.3.30 Product_context to Mechanical_product

Each Product_context refers to a set of one or many Mechanical_products. A set of Mechanical_products defines the defined_for for Product_context.

4.3.31 Product_material to Mechanical_product

Each Product_material refers to a set of one or many Mechanical_products. A set of Mechanical_products defines the defined_for for Product_material .

4.3.32 Product_participation to Mechanical_product

Each Product_participation refers to a set of one or many Mechanical_products. A set of Mechanical_products defines the defined_for for Product_participation .

4.3.33 Product_placement to Mechanical_product

Each Product_placement refers to a set of one or many Mechanical_products. A set of Mechanical_products defines the defined_for for Product_placement .

4.3.34 Product_status to Mechanical_product

Each Product_status refers to a set of one or many Mechanical_products. A set of Mechanical_products defines the defined_for for Product_status.

The remainder of the application assertions will be defined at a later date.

5 Application interpreted model

5.1 Mapping Table

This clause contains the mapping table that shows how each UoF and application object of this part of ISO 10303 (see clause 4) maps to one or more AIM constructs (see Annex A).

To be completed at a later date.

5.2 AIM EXPRESS short listing

This clause specifies the EXPRESS schema that uses elements from the integrated resources and the AICs and contains types, entity specialisations, rules and functions that are specific to this part of ISO 10303. This clause also specifies modification to the textual material for constructs that are imported from the integrated resources and the AICs. The definitions and EXPRESS provided in the integrated resources for constructs used in the AIM may include select list items and subtypes which are not imported into the AIM. Requirements stated in the integrated resources which refer to such items and subtypes apply exclusively to those items which are imported into the AIM.

To be completed at a later date.

6 Conformance requirements

Conformance to this part of ISO 10303 includes satisfying the requirements stated in this part, the requirements of the implementation methods supported, and the relevant requirements of the normative references.

An implementation shall support at least one of the following implementation methods:

- ISO 10303-21
- ISO 10303-22.

Requirements with respect to implementation methods are specified in annex C.

The Protocol Information Conformance Statement (PICS) proforma lists the options or the combinations of options that may be included in the implementation. The PICS proforma is provided in annex D.

NOTE 1 ISO 10303-326: - ¹⁾ defines the abstract test suite to be used in the assessment of conformance.

NOTE 2 ISO 10303-32: - ¹⁾ describes the conformance assessment process.

Conformance to a particular class requires that all AIM elements defined as part of that class be supported. Table (*to be specified later*) defines the classes to which each AIM element belongs. The conformance classes are characterised as follows:

This part of ISO 10303 specifies a number of conformance classes that may be supported by an implementation. The conformance classes are:

- Class 1, the shape representation of the mechanical systems and their principal equipment together with their product structure and connectivity information. This class excludes all the functional and design characteristics of the systems/equipment.
- Class 2, the general characteristics and specifications of the mechanical systems and their principal equipments.
- Class 3, functional design characteristics of mechanical systems and their principal equipment primarily in the form of parametric definitions. This class contains only functional information, but no detailed geometric and other physical and spatial details.
- Class 4, operational characteristics of mechanical products. This class contains only operational information (as normally measured on-board ship), but no geometric, physical, spatial and design characteristics details.
- Class 5, task and activity information as carried out in relation to mechanical equipments. This class excludes any functional, physical, spatial or design information and will include information on activities carried out in relation to mechanical products. Also, exchange of data for all types of product anomaly such as faults and failures are included in this conformance class.
- Class 6, engineering analysis information relating to the mechanical products. This class includes all technical data relating to and resulting from various engineering analysis tasks carried out in relation to mechanical product.

Table 1 defines the division of conformance classes and the related units of functionality within a conformance class

Table 1 - Conformance Classes

Unit of functionality	Conformance Class					
	1	2	3	4	5	6
configuration_definitions	X	X	X	X	X	X
connecting_components	X				X	
connector_components	X				X	
control_components	X				X	
cranes	X	X	X	X	X	X
date_and_time	X	X	X	X	X	X
diesel_engines	X	X	X	X	X	X
electric_power_generation_systems	X	X	X	X	X	X
electrical_machineries	X	X	X	X	X	X
external_references	X	X	X	X	X	X
external_resources_requirements		X	X	X	X	X
failures					X	
faults					X	
gas_turbine_engines	X	X	X	X	X	X
gear_boxes	X	X	X	X	X	X
generic_components	X				X	
generic equipments	X	X	X	X	X	X
heat_exchangers	X	X	X	X	X	X
local_co_ordinate_systems	X					
machineries	X	X	X	X	X	X
machinery_piping_systems	X	X	X	X	X	X
maintenance_tasks					X	
material_properties						X
materials						X
measure_with_units	X	X	X	X	X	X
mechanical_components	X				X	
mechanical equipments	X	X	X	X	X	X
mechanical_product_anomalies				X	X	
mechanical_product_connections	X					
mechanical_product_definitions	X	X	X	X	X	X
mechanical_product equipments	X	X	X	X	X	X
mechanical_product_properties		X	X	X	X	X
mechanical_product_representations	X					
mechanical_product_structures	X			X	X	
mechanical_product_systems	X	X	X	X	X	X
mechanical_products	X	X	X	X	X	X
other equipments	X	X	X	X	X	X
other_systems	X	X	X	X	X	X
part_library_references	X	X	X	X	X	X
part41_resources	X	X	X	X	X	X
part42_resources	X	X	X	X	X	X
piping_components	X				X	

process equipments	X	X	X	X	X	X
process machineries	X	X	X	X	X	X
procurement definitions				X	X	
product_connection_general_characteristics	X					
pumps	X	X	X	X	X	X
RAM_characteristics				X	X	
rotating_components	X				X	
screw_propellers	X	X	X	X	X	X
shafts	X			X	X	X
ship_voyages					X	
ships	X	X	X	X	X	X
task_definitions					X	
tasks					X	
time_and_events	X	X	X	X	X	X